June 22, 1978

Brancalla brevis collected
February 1978 by Mark Hallett from
San Diego Fm. on Brooks St,
San Diego – LACM locality 4442

Loon tarsometatarsus
length 42.7 mm (small!)

Fulmar? Distal end tibiotarsus
Br. dist. 7.4 mm
depth " 7.8 mm

Check for further specimens

1969?

Humboldt Co. Macoma calla humerus

Length to ant. condyle	81.0	
Gr. length	81.8	
Br. Prox. end	19.3	(Type of Calif. = 19.7)
Br. dist. end	6.9	
Depth shaft through deltoid	16.8	(Type of Calif. = 11.7)
Br. middle of shaft	4.3	(" " " = 4.8)
Ht ectepicondylar process	17.5	
Length to end of deltoid curve	55.0	(Type of Calif. = 51.0)
Length to widest part of deltoid just above distal end	53.3	(" " " 50.5)

Muscle ridge anconally below pectoral attachment coincides with apex of shaft. In M. calif. the apex rounds out to the ridge and the whole shaft is fuller and more rounded. M. diegensis is like the Humboldt specimen

Differs from M. calif. in ridge do not go as far into the pneumatic fossa and are not as far apart and seem to unite proximally. Bone is slimmer, more angular in anconal aspect, lacking the deep curvature (ext. convexity) of M. calif.

[Note: June 22 1978. Amino acid age date for Crannell Unit, ~70,000 yrs BP ± 100 based on invertebrates

Abstract of: "Amino Acid Racemization Dating of Quaternary Mollusks, Pac. Coast, U.S." by 5 authors including Geo. Kennedy U.C. Davis who sent a xeroxed copy of manuscript - still unpublished.]

2	3	4	5	6
9	10	11	12	13
16	17	18	19	20
23	24	25	26	27
30	31			

Genus Mancalla

The general characters of the individual elements of Mancalla described by Miller and Howard (1949) are still substantially characteristic of the genus. Deviations at the specific level now require clarification. Augmented diagnoses of the species Mancalla californiensis and M. diegense are therefore here presented, and a third species is described.

Miller and Howard (op. cit. :225) and Miller (1956:618) noted considerable range in size in the specimens from San Diego and suggested that two species were represented. The additional material now available from San Diego extends the size range even further, and substantiates this suggestion. In the best represented element, the humerus, greatest length can be measured on 30 bones, and a measurement of proximal breadth on twice this number. In length the maximum bone is 151 per cent of the minimum with a coefficient of variability for the series, of 10.2 In a series of 200 humeri of the Great Auk recorded by Lucas (188:493) the maximum bone is only 114 per cent of the minimum in greatest length, and the series has a coefficient of variability of 3.0.

The distributional curve for the greatest length of the San Diego Mancalla humeri is distinctly bimodal, with more than 2/3 of the specimens falling below 66.5 mm. and the remaining 7 measuring 71 mm. or more. The curve of distribution plotted for the breadth of the proximal end, adds 14 specimens to the larger group, 17 to the smaller, and tends to clarify the curve for the former. See figs. 1 and 2. According to Simpson, Roe and Lewontin (1960:102 and 205) bimodality of curve, plus a large coefficient of variability is strongly suggestive of heterogeneity of the sample. They state further (op. cit:207) that unless changes due to growth are involved, a homogeneous sample for a linear dimension usually has a coefficient of variability of 3 to 7 in mammals. Birds are said to tend to lower V than mammals.

7.24.65

B

None of the other skeletal elements of Mancalla are as abundant as the humerus, but each shows a wide range in measurement of length, and coefficient of variability greater than in excess of 7. See Table 1

That the range in size cannot be attributed to age is evidenced by the state of ossification of the bones measured. It is further marked by the fact that in the tibiotarsi, the five specimens in which the supratendinal bridge at the distal end is present and ossified all fall within the group of smaller specimens. In fact the minimum bone is one of those with a complete bridge.

If each of the elements represented in Table 1 is divided on the basis of the general bimodality of distribution, the resulting groups formed show a size range and variability in keeping with homogeneous samples (see Table 2). It seems proper, therefore, now definitely to assert that two species of Mancalla are represented in the San Diego material, and to establish as nearly as possible criteria by which they may be recognized and distinguished.

The type of Mancalla diegense is a femur, originally described as Pliolunda diegense (Miller 1937:376). Pliolunda has become a synonym of Mancalla (see Miller and Howard, 1949:225). When the series of femora now available is examined, this femur is found to be the longest of the seven specimens on which a linear measurement can be made. It is also the broadest distally, and next to broadest in proximal breadth. There is no alternative, therefore, but to recognize that the small, most abundant species represented in the San Diego Pliocene can no longer hold the title of Mancalla diegense. For that small species, I now, therefore, propose the name

Mancalla milleri n. sp.

Furthermore the type of M. diegense stands apart from all the remains from San Diego now available in the contours of the proximal end, especially the forward deflection of the anterior border of the internal articular facet, which is not as deep,

The previous assumption that, if two species were represented in the San Diego material, the larger was assignable to Mancalla californiensis, ~~also~~ now proves ~~now~~ to be in error. On the other hand the addition of a proximal end of humerus to the collection of Mancalla bones from Corona del Mar, ~~now~~ affords ~~and~~ direct comparison with the type of M. californiensis, ~~and~~ substantiates the assignment of ~~the~~ material from this locality to M. californiensis. Comparison of the San Diego bones to the type humerus of M. californiensis and to other elements represented in the Corona del Mar collection, show distinguishing characters. ~~The name Mancalla diegense, therefore, remains valid for the larger of the two San Diego species.~~ There Distinctions ~~between M. californiensis and M. diegense~~ are shown in Table 3, Measurements of M. californiensis in Table 4

For the small, dominant San Diego species I propose the name

Mancalla milleri, n. sp.

Table 3

Comparison of Mancalla californiensis and M. diegense*

	M. californiensis	M. diegense
Humerus		
Capital groove (anconally)	Narrow: 9.0-9.2 % of breadth of proximal end of humerus measured with calipers flat against deltoid crest, to bicipital contour	Broad: 11.0-14.0 % of proximal breadth of humerus.
Tricipital attachment below pneumatic fossa	Bordered by nearly parallel ridges running up into pneumatic fossa	Triangular, bordering lines meeting proximally and (with but 2 exceptions well outside pneumatic fossa
Pneumatic fossa	Wide, and only moderately overhung by internal tuberosity	Constricted and rounded; internal tuberosity tending to overhang
Carpometacarpus		
Internal trochlear crest	Not clearly demarcated from metacarpal 3	Clear indentation separates crest from M 3
Metacarpal 3	Cross section deeper than wide	Cross section wider than deep
Process of metacarpal 1	16.6 - 17.7 mm. long (4 specimens)	Not exceeding 15.4 mm. (6 specimens)
Proximal symphysis of M 2 & 3	Distal terminus at or above level of middle of process of metacarpal 1	Distal terminus at or slightly below level of middle of process of metacarpal 1.
Coracoid		
Anterior border of triosseal canal	Medial to anterior surface of coracoid and tip of furcular facet	At anterior edge of furcoracoid and below tip of furcular facet.
Tip of furcular facet	Blunt	Pointed
Tarsometatarsus		
Anterior face of shaft	Faintly depressed immediately above distal foramen, but centrally level or tending to convexity	Marked groove extending proximally along external edge above distal foramen
External border of shaft	Indistinctly raissd	Distinctly raised for full length of shaft

* The femur, the type element of M. diegense, has not as yet been known from Coronado del Mar!

Table 4

Measurements of Skeletal Elements of Mancalla californiensis ~~from Corona del Mar~~

	Newport Bay meaa deposits		3rd St., Los Angeles type humerus
Humerus			
Breadth prox. end	18.9 mm.	(no. 2576)	19.5 mm.
Depth shaft proximally through deltoid crest	13.1	(no. 2577)	11.3
Distance between end of deltoid crest and tip of ectepicondylar process			~~16.5?~~
Transverse breadth shaft (above ectepicondylar process)	4.7	(no. 2577)	4.9 ?
Depth shaft at same place	10.2		9.1 ?
Coracoid			
Height from below scapular facet to middle of head	18.8		
Height furcular facet at tip	5.1		
Breadth across furcular fac.	8.7		
Antero-posterior depth through scapular facet	6.3		
Ulna			
Depth of shaft	6.7		
Depth proximal end (estimated	10.7		
Radius			
Length	29.7		
Greatest depth shaft	6.8		
Carpometacarpus			
Greatest length	41.2	(no.2578)	
Length process M1	16.6 - 17.7 mm.		
Greatest depth prox. end through process M1	11.3 - 11.7		
Breadth trochlea	~~11.7 - 12~~ 4.5 - 5.1		

Least variability is shown in the proximal wrist elements and in the femur.

The coracoid humerus + tibiotarsus divide readily into small and large groups, which when analyzed for range + variability suggest the subspecific homogeneity. See Table 2

The ulnae + radii The joint of division in the ulnae + radii is more difficult to determine for the ulnae with less than ten specimens But large + small groups

As linear dimensions can be made on less than 10 specimens of the radii, femora + tarsometatarsi, division in these elements is unreliable. The coracoid humerus + tibiotarsus, each have ten specimens markedly larger than the others, separated, in fact from other large specimens by an interval as great or nearly as great as that which separates the entire large series from the small series.

Society annual meeting of 1950 on this subject, demonstrating the great range in size to be found in the bones from San Diego, particularly in the series of humeri. At that time we had only 11 humeri. There are now three times that many humeri on which a measurement of length can be taken and many more incomplete specimens, as well as large series of most other elements of the skeleton. It has been possible to prepare a composite mount of Mancalla from the San Diego material (see Howard, 1953).

Material Available For This Study

In the combined collections of the Los Angeles County Museum, University of California at Los Angeles and University of California, Berkeley, there are now over 450 individual bones of Mancalla from the San Diego sites, on which some measurements can be taken. The elements represented are:

		Complete	Incomplete	Frag. (unmeas)
2	Humerus	33	73	26
1	Ulna	19	16	1
1	Radius	7	4	
4	Carpometacarpus	10	5	6
0	Femur	7	29	2
1	Tibiotarsus	14	33	7
3	Tarsometatarsus	9	13	4
1	Coracoid	20	13	11
0	Scapula	11 (breadth)	13 (frags.)	
0	Sternum	7 (breadth)		
0	Pelvis			
	Misc. vertebrae phalanges, etc. skull parts (2)	2		

4.3
12) 5.2
48
40
36
42

120.3
177) 213
177
360
354
600
531

124.1
170) 211
170
410
340
700
680
20

123.5
166) 205
166
390
332
580
498
820
830
3

11.1) 470
444
240
40

124.8
141) 176
141
350
282
680
564
1160
1128
32

132
139) 183
139
440
407
330
278
520
430
90

41
91) 380
364
160

41
117) 490
468
220

121.9
140) 172
141
310
282
280
141
1390
1269
121

140) 174
140
340
280
600
560
400

43
11) 480
44
40
44
27

129.7
141) 183
141
420
282
1380
1269
110

139) 1760
139
370
278
920
834
860
807

12.3) 17.6
123
530
492
380
369
110
46.4

178) 480
356
1240

46
14) 650
56
90
84
6

40) 330
320
10
8

130) 183
130
530
520
1000
1186

86) 133
86
470
430
400
344
560

143) 640
572
680
5

33) 40
33
70
66
40
33
7

86) 102
86
160
86
74
68
6

86) 133
86
470
430
400
344
560

105) 570
4
110) 520

42) 409
378
310
210
100

55) 470
440
300
275
25

520

To Ted
June 10, 1970

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A REVIEW OF THE EXTINCT AVIAN GENUS, MANCALLA

By

Hildegarde Howard

Abstract: With the large number of fossil bones of the flightless auk, Mancalla (Charadriiformes: Alcidae: Mancallinae) now at hand, it has been possible to study variability within the genus, verify the assignment of the Corona del Mar specimens to the ggenotype, Mancalla californiensis, and demonstrate statistically the presence of two species in the San Diego Formation. The name Mancalla diegense must now be applied to the larger (and less well represented) of the two San Diego species. The smaller, more abundant species is here described: Mancalla milleri sp. n.

New locality records for the genus are cited, extending its gange to Humboldt County, California, in the north and to Baja California in the south.

1 p. abstract
14 pp. text
4 tables
1 illus
1 legend for illus + footnote

Correctives pp: 1, 3, 4, 5, 6, 7, 8 9 12 Table 1 Table 3

A REVIEW OF THE EXTINCT AVIAN GENUS, MANCALLA

By

Hildegarde Howard[1]

INTRODUCTION

Since the last major report on the genus Mancalla (Miller and Howard, 1949), much additional material has become available from the previously recorded localities within the city of San Diego, California and from the Corona del Mar site near the upper end of Newport Bay, Orange County, California. Where before there were but four bones from the latter locality, representing only carpometacarpus, tarsometatarsus (2) and vertebra, there are now fourteen, including another tarsometatarsus and three more carpometacarpi, and adding coracoid, two humeri (proximal and distal ends), ulna, radius and tibiotarsus. From the several San Diego sites, over 350 specimens are added, bringing the total now available close to 500, in contrast to 145 in 1949. This material is included in the collections of the Los Angeles County Museum of Natural History (LACM, approximately 400), University of California Museum of Paleontology (UCMP, 48), the Loye H. Miller collection of the University of California at Los Angeles (LHM, 50), and the San Diego State College (SDSC, 3).

Besides the material from these previously discussed sites, three new areas of occurrence of Mancalla have come to light. One is located in northern California, near the small town of Crannell (Humboldt County), another in southern California, in Laguna Hills (Orange County), and the third on Cedros Island, Baja California, Mexico. A perfect humerus in the Humboldt State College (HSC) is the sole representative from the northern locality (HSC locality 197).

LACM localities 65120 and 65121 in the Laguna Hills area have yielded 26 bones, most of which are incomplete with contours obscured by mottled coloring and roughened surfaces. The 55 bones from Cedros Island were collected on an expedition from the University of California, Riverside (UCR), and were donated to the Los Angeles County Museum of Natural History (LACM locs. 65144 to 65154 inclusive). Although many of the Cedros bones are incomplete, the contours are clear and preservation is good. In several instances skeletal elements were found associated.

The increased representation of Mancalla has provided the opportunity of determining variability within the genus, and the associated skeletal material from Cedros Island has contributed to an understanding of skeletal proportions. The present Catalogue of Fossil Birds (Brodkorb, 1967) lists Mancalla californiensis from the type locality in Los Angeles and from the Corona del Mar site; and only M. diegense from San Diego. Both Miller (1956) and Howard (1966), however, have indicated increasing confidence that the great range in size of specimens from San Diego indicates that more than one species of Mancalla is represented there. The present study not only corroborates this belief, but clarifies the species assignments, resulting in the description of a new species from San Diego.

The Humboldt County humerus and the Laguna Hills bones resemble the San Diego specimens, but the Cedros Island material is distinct. The description of this species is ~~the subject of~~ included in a separate paper (Howard, MS).

ANALYSIS OF SPECIES

Mancalla californiensis Lucas

The type of *Mancalla californiensis* (a humerus lacking the distal end) is the only representative of the species recorded from the type locality -- the Third Street tunnel excavation in Los Angeles (Lucas, 1901).

The later recording of *M. californiensis* from Corona del Mar (Howard, 1949) was based on the large size of the carpometacarpus (no humerus being represented). At San Diego, the few fragments of large humeri among the much more abundant small specimens suggested *M. californiensis* (Miller, 1956), but were too imperfect for anything except a size comparison.

Later excavations have brought to light a proximal end of a humerus from Corona del Mar, and several well-preserved specimens of the element from San Diego that equal or closely approximate the type of *M. californiensis* in length and/or breadth of proximal end. It is, therefore, at last possible to make direct comparison with the type of *M. californiensis* -- a good cast of which is at hand.

It was previously noted by Miller and Howard (1949) that the type humerus of *M. californiensis* differed from the then available San Diego humeri not only in its large size, but in the position of the muscle scar at the median border of the pneumatic fossa, and the character of the adjacent depression. The difference was described as follows (*op.cit.*:209): "In the type of *Mancalla californiensis* the proximal tip of this scar is situated farther within the fossa than in any of the San Diego specimens, and the depression is thus allowed to extend farther proximally as well, taking the form of a distinct groove with clear-cut, ridgelike edges running up alongside the median partition of the fossa." The specimen from Corona del

Mar (LACM 2576) matches the type of M. californiensis precisely. Further notable is the fact that in both the type and the Corona del Mar humerus these "ridgelike edges" remain separate for their full extent up into the pneumatic fossa, whereas in the San Diego specimens they converge proximally.

Other distinctions in the type humerus of M. californiensis and the large humeri from San Diego pertain to the greater curvature of the shaft in the former and the less prominent projection of the distal contour of the bicipital crest. The shaft character can be observed only in the type of M. californiensis, the Corona del Mar humerus is broken below the bicipital crest.

Distinction between the Corona del Mar and the San Diego material is evidenced also in the coracoid, ulna, radius, carpometacarpus, tibiotarsus and tarsometatarsus. Characteristics of these elements from Corona del Mar are now assumed to apply to the species M. californiensis. See Table I. With the exception of the carpometacarpi, all available specimens from Corona del Mar fall within the range in size of the San Diego bones in linear dimension. The carpometacarpi are longer and have a longer process of metacarpal 1.

Measurements of Corona del Mar specimens assigned to Mancalla californiensis: Humerus (LACM 2576) greatest breadth of proximal end 19.4 mm; (LACM 2577) breadth and depth of shaft above ectepicondylar process 4.7 x 10.2 mm. Coracoid (LACM 2581) height from below scapular facet to middle of head 18.8 mm; breadth across furcular facet 8.7 mm; breadth through triosseal canal, 5.9 mm; height of furcular facet at tip 5.1 mm. Ulna (incomplete, LACM 2580) depth of shaft 6.7 mm; depth of proximal end (estimated) 10.7 mm. Radius (LACM 2579) greatest length 29.7 mm; greatest depth of shfft 6.8 mm. Carpometacarpus ~~(LACM 2578)~~ greatest length 41.3 mm; height of process of metacarpal 1, 17.8 mm; greatest depth of proximal end through

process of metacarpal 1, 11.0 mm; breadth of proximal trochlea 4.8 mm. Tibiotarsus (LACM 2424) estimated length 87.5 mm.; breadth of proximal end 8.6 mm.; least breadth of shaft 6.1 mm. Tarsometatarsus (LACM 2250) leng th from intercotylar tuberosity to external trochlea (middle trochlea broken) 39.3 mm.; breadth of distal end 9.3 mm.; breadth of proximal end 9.9 mm.; breadth of shaft (middle) 4.8 mm.

Mancalla diegense (Miller)

The large collection of Mancalla bones now available from San Diego exhibits a greater range in size than was previously suggested by the material available in 1949. The humerus is the best represented element. Of over 130 humeri now at hand, 100 can be measured for proximal or distal breadth and 34 of these also provide a linear measurement. In length, the maximum bone is 151 per cent of the minimum, with a coefficient of variability (V) of 10.2 for the series. In a series of 300 humeri of the flightless auk, Pinguinis impennis, recorded by Lucas (1888:521), the maximum bone is only 114 per cent of the minimum in greatest length, and the series has a V of 3.0.

The distribution curve for length of the Mancalla humeri is roughly bimodal. The 26 specimens that fall below 66.6 mm form a normal curve with a mode of 63 mm and a mean of 62.8 mm. The remaining eight specimens are scattered from 71 to 85 mm with a mean of 75.5 mm. The 64 specimens in which proximal breadth can be measured provide a distinct bimodal curve in which the smaller specimens range from 14.2 to 16.4 mm with a mean of 15.3 mm, and the larger bones range from 17.3 to 20.3 mm with a mean of 18.7 mm.

According to Simpson, Roe and Lewontin (1960:102 and 205) bimodality of curve plus a large coefficient of variability is

suggestive of heterogeneity of the sample. They state further (op. cit. : 207) that unless changes due to growth are involved, a homogeneous sample for a linear dimension usually has a V of 3 to 7 in mammals, and is lower in birds. That the range in Mancalla cannot be attributed to age is evidenced by the state of ossification of the bones measured.

These statistical criteria applied to the Mancalla humeri indicate heterogeneity of the San Diego sample, and comparison with the lesser range and small V of the Pinguinis humeri lends further proof. As the large and small bones are intermingled throughout the deposits, it seems reasonable to assume that the distinction is specific rather than subspecific. Previously it was assumed that, if two species were represented, the larger one was M. californiensis. We have seen above (Table I), however, that ~~none of the San Diego material can be assigned to M. californiensis~~ this is not the case.

The size range and coefficient of variability has been determined for all of the limb elements of the San Diego Mancalla. Each shows a wide range in measurement of length and a V greater than 7 (see Table II). For the type element of M. diegense, the femur, exact measurement of greatest length can be made on 10 specimens and estimated on another ~~four~~ four. Breadth of distal end can also be measured. Five bones have a length from 57.0 to 53.8 mm and a distal breadth from 11.1 to 9.~~7~~5 mm. The other nine measure from 51.1 to ~~44.9~~ 45.0 mm in length with a distal breadth from 9.3 to 8.~~7~~4 mm. The type of M. diegense (UCMP 33409) measures 56.3 mm in length and 11.0 mm in distal breadth -- next to the maximum in both measurements and 25 per cent longer than the minimum specimen. From these figures it is concluded that the name Mancalla diegense must now be applied to the large San Diego species rather than to the more abundant small form. The small form is,

therefore, here described as new.

In some elements the point of linear separation between the large and small species is not clearly demarcated. To determine the placement of "borderline" specimens, measurements of breadth and qualitative characters were taken into account (see Tables III and IV). Comparisons with the partial skeletons from Cedros Island were also helpful, as this island species was apparently near in size to M. diegense.

In the San Diego collection, approximately 50 complete limb elements and an equal number of incomplete specimens are now identified as M. diegense. Among these, the following were illustrated by Miller and Howard (1949): scapula LACM 2176 and 2049 (Pl. 4, figs. 5 and 7); coracoid LACM 2087 and 2067 (Pl. 3, figs. 2 and 3); humerus LHM 2220 and 2220 (Pl. 3, figs. 6 and 14); ulna LACM 2064 (Pl. 3, fig. 7); carpometacarpus LACM 2068 (Pl. 4, fig. 16); femur LHM 2220 (Pl. 4, fig. 2); tibiotarsus LACM 2125 and LHM 2220 (Pl. 4, figs. 9 and 11), and LACM 2177 (Pl. 5, fig. 1); tarsometatarsus LACM 2178 and 2177 (Pl. 5, figs. 4 and 5). One sternal fragment (LACM 2333) and one cranium with associated rostrum (LACM 2633) are outstandingly large and are tentatively assigned to M. diegense.

The humerus from Humboldt County conforms in all respects with humeri of M. diegense and is so assigned. Measurements of this bone are as follows: length 81.3 mm, breadth of proximal end 19.5 mm. Preservation of the Laguna Hills specimens is poor, but all are clearly distinct from M. californiensis. With the exception of two small ulnae, all appear to resemble M. diegense and are tentatively so assigned.

Mancalla milleri new species

Type: Complete left femur, LACM 2185, collected by Clifford Kennell, Dec. 26, 1947. Illustrated in Miller and Howard, 1949, plate 5, fig. 3, as "Mancalla diegense."

Locality: LACM locality 1070, east side of Curlew Street, across from end of Ostego Drive, San Diego, California.

Paratype: Complete left humerus, LACM 2813, collected July, 1962 from type locality.

Formation and Age: San Diego Formation, Middle (?) Pliocene.

Referred Material: In addition to the type and paratype, 86 limb elements on which a measurement of length can be made are referred to M. milleri, as follows: 12 coracoids, 24 humeri, 16 ulnae, 6 radii, 7 carpometacarpi, 8 femora, 8 tibiotarsi and 5 tarsometatarsi. There are also 13 scapulae and at least five incomplete sterna, two pelves, a cranium, and numerous incomplete limb bones whose size indicates assignment to M. milleri. The following elements illustrated by Miller and Howard (1949) as "Mancalla diegense" are now assigned to Mancalla milleri: scapulae, LACM 2070 and LHM 2270 (Pl. 4, figs. 4 and 6); coracoid LHM 2270 (Pl. 3, fig. 1); humeri LHM 2218 (Pl. 1 fig. 1), LHM 2269, LACM 2066, 2096, and LHM 2281 (Pl. 2, figs. 1, 2, 3 and 4); ulnae LACM 2069 (Pl. 1, fig. 1), LACM 2082 (Pl. 1, fig. 2 and Pl. 3, fig. 8), LACM 2079 and 2101 (Pl. 3, figs. 9 and 10), and LACM 2179 (Pl. 5, fig. 2); radius LHM 2270 (Pl. 1, figs. 1 and 6, and Pl. 4, fig. 3); carpometacarpi LHM 2068 (Pl. 1, figs. 1 and 3, and Pl. 4, fig. 15), and LHM 2281 (Pl. 4, fig. 17); femur LACM 2097 (Pl. 4, fig. 1); tibiotarsi LACM 2083, 2100 LH M 2270, LACM 2105 and 2134 (Pl. 4, figs. 8, 10, 12, 13 and 14): sterna LH M 2220 and LACM 2063 (Pl. 2, figs. 6 and 7) and LACM 2180 (Pl. 6, fig. 1); pelvis LHM 2281 (Pl. 2, fig. 5) and LACM 2182 (Pl. 6, fig. 2).

Diagnosis: Type femur 16 per cent shorter than type of M. diegense; deep excavation on internal side of obturator ridge. Mean of nine femora 13 per cent shorter than mean of five femora of M. diegense. Paratype humerus 25 per cent shorter than type of M. californiensis (using dimension of length from proximal end to distal tip of deltoid crest to accommodate to incomplete specimen of M. californiensis); mean of 25 humeri 18 per cent shorter in over all length than mean of 7 humeri of M. diegense.

Description: The smallest known species of Mancalla; averaging 12 to 19 per cent smaller than M. diegense in comparable elements (see Table III). Poor preservation of the San Diego material, and considerable variability make qualitative distinctions from M. diegense difficult to observe. Those which appear to be constant are shown in Table IV.

Of ten specimens of tibiotarsi in which the supratendinal bridge is fully ossified and intact, seven are clearly assignable to M. milleri. This fact indicates that the small size of the tibiotarsi cannot be attributed to immaturity.

Measurements of type and paratype: Femur LACM 2185, greatest length 47.3 mm; depth through trochanter and obturator ridge 6.3 mm; breadth of distal end 8.2 mm; least breadth of shaft 4.0 mm. Humerus LACM 2813, length to internal condyle 58.1 mm; breadth of proximal end 14.8 mm; breadth of distal end 5.2 mm; length from head to distal tip of deltoid crest 38.7 mm.

See Table III for size range of all specimens assigned to M. milleri.

A MOUNTED SKELETON OF MANCALLA

A composite mount of Mancalla is displayed at the Los Angeles County Museum of Natural History (see Howard, 1953). At the time of selection of material for the mount, in 1953, there were 224 bones of Mancalla in the museum collection, representing at least fragmentary specimens of the main elements. Vertebrae, ribs and phalanges, however, were incompletely represented, and these elements were supplied from a modern skeleton of Uria aalge californica.

For the skull and pelvis the choice was limited to one good specimen each (LACM 2205 and 2182 respectively). The two available sterna appeared to correlate in size with the pelvis, and the better specimen was chosen (LACM 2063). The choice of coracoids (LACM 2243 and 2208) was based on the proper fit of the sternal facet into the coracoidal sulci of the sternum. Two scapulae (unnumbered) appe red suitable for articulation with the coracoids, and two humeri (LACM 2442 and 2303), in turn, seemed to conform reasonably well to the glenoid area formed by the coracoid and scapula.

According to the size now established for these elements of the two San Diego species, the humeri and scapulae are found to be of average size for M. milleri; the right coracoid is slightly above average, the other slightly below; the single radius (LACM 2335) available at the time proves to be of maximum size for M. milleri; the ulnae (LACM 2543 and 2544) and carpometacarpi (LACM 2213 and an unnumbered specimen) fall within the size range for M. diegense. Femora were scarce, but one complete (LACM 2097) and one proximal end (unnumbered) seemed appropriate for the size of the acetabulae of the pelvis. The complete left femur proves to be

considerably above the average for M. milleri, but still within its size range. The right tibiotarsus and tarsometatarsus (LACM 2177) that were found together in the matrix (see Miller and Howard, 1949: 226) were chosen for the other two elements of the leg. Both specimens are near the borderline between M. diegense and M. milleri in length but are now considered to be of minimum size for M. diegense. Also the contours of the tarsometatarsus and the stocky proportions of the tibiotarsus are characteristic of M. diegense. The character of the tibiotarsus of the proximal articular surface described in Table IV cannot be ascertained now that the bone is in the mount. However, the illustration of the specimen (Miller and Howard, 1949: Pl. 5, fig. 1b) suggests the separation of the two surfaces as in M. diegense.

In the light of our present knowledge of Mancalla, the mount which we hoped would represent an average-sized specimen of the dominant San Diego species, is above the average of M. milleri in many of its elements and disproportionately large in the terminal segments of the wing and leg. If our judgment is correct concerning the size break between M. diegense and M. milleri, the skull, limb girdles, sternum, humeri, radius and femora represent M. milleri. But the ulnae, carpometacarpus, tibiotarsus and tarsometatarsus represent M. diegense. Herein lies an excellent example of the pitfalls of building a composite mount!

SUMMARY AND CONCLUSIONS

With three times more specimens at hand, than were available to Miller and Howard (1949) at the time of their comprehensive report on Mancalla, the present sutdy has contributed considerably to an understanding of the taxonomy and distribution of the genus.

1. The geographic distribution of the genus is enlarged from southern California to a wide extent along the west coast of North America from Humboldt County, California in the north to Cedros Island, Baja California, Mexico in the south.

2. Identification of Mancalla californiensis from Corona del Mar locality, ~~which was~~ formerly based only on size, is confirmed by the diadovery of a humerus at the latter locality comparable to the type specimen from Los Angeles.

3. The greatly enlarged collection of Mancalla bones from the San Diego sites exhibits so great a range in size that the presence of two species, as previously postulated, can be statistically demonstrated.

4. The larger of the two San Diego species conforms with Mancalla californiensis in size, but differs qualitatively. The type femur of M. diegense is found to be one of the largest of the femora in the collection, and the large San Diego species, therefore, takes the name of M. diegense.

5. The smaller, more abundant species from San Diego is described in honor of the late Professor Loye Miller, whose contributions have formed the basis for the growth of paleornithology on the west coast.

ACKNOWLEDGMENTS

I wish to express my appreciation to the University of California Museum of Paleontology in Berkeley, the University of California at Los Angeles and the San Diego State College for the loan of fossils, and for their indulgence in permitting the extensions of these loans for the long period of time necessary to study this complicated problem. Personal thanks are extended to Mr. Roy Kohl for sending the Humboldt County specimen, to Mrs. Jean Cohn for assistance and information regarding the San Diego State College material, and to Dr. Richard Tedford and Dr. Frank Kilmer for geological information concerning the fossil deposits in which Mancalla occurs. Dr. Tedford is also responsible for the gift of the Cedros Island material to the Los Angeles County Museum of Natural History. To the Los Angeles County Museum of Natural History I am continually grateful for the opportunity to use the collections, and to the museum staff for their many kindnesses.

It has been a privilege to have had numerous conferences with the late Professor Loye Miller during the period of this study, and to have had his blessing on the conclusions reached.

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pp?

whose work contributed largely to the growth of paleornithological knowledge on the west coast, whose contributions formed the basis for the growth of paleornithological work on the west coast.

Muscle scars & ridges in adults less well defined:

TABLE I

Comparison of Mancalla californiensis and M. diegense

Element	M. californiensis	M. milleri diegense
HUMERUSS	Muscle scar well within pneumatic fossa and ridge-like edges of depression parallel	Scar less extended within fossa and ridges converging.
	Curvature of shaft pronounced	Shaft straighter
	Contour of bicipital crest rounded distally	Crest prominently projected distally (angular)
CORACOID	Anterior border of triosseal canal slightly posterior to anterior border of shaft	Border of triosseal canal forming anterior border of the bone
	Upper surface of head broad; smoothly rounded	Upper surface of head narrow with central ridge
	Tip of furcular facet blunt; no up-turned point	Tip of furcular facet with up-turned point
ULNA	Proximal profile from olecranon to cotylae broad and shallow; olecranon blunt	Profile depressed; olecranon more bulbous
	Palmar side of shaft above distal end flat, bordered by well-marked intermuscular lines	Palmar side of shaft rounded; slanting from internal to external side
RADIUS	External surface smooth; no depression below head	External surface rugose, with marked depression below head
	Groove on lateral edge extending nearly halfway up shaft	Groove extending less than 1/3 length of bone
CARPOMETACARPUS	Length 41 mm; length process metacarpal 1, 16.6-17.7 mm	Maximum length 37 mm; length process metacarpal 1, 15.4 mm
	Internal trochlear crest not clearly separated from M 3	Base of internal trochlear crest clearly separated from M 3
TIBIOTARSUS	proximo-internal ligamental attachment short, broad, flat and partly on posterior surface of shaft	Attachment long, thin straight ridge on internal edge shaft
TARSOMETATARSUS	Anterior shaft (external) bevel indistinctly raised	Marked groove extending proximally from distal foramen to external edge; external border raised for full shaft length

TABLE II

Size Range and Variability in Length[1] of Limb Elements of *Mancalla* from San Diego

Element	Number of specimens	Length in mm max.	mean	min.	Ratio of maximum to minimum (in percent)	Coefficient of variability (V)
Coracoid	21	54.0	43.5	39.0	138	11.1
Humerus	32	85.2	65.9	56.4	151	10.2
Ulna	23	32.1	26.3	23.6	135	7.8
Radius	9	31.8	27.1	24.2	131	11.5
Carpometacarpus	14	37.2	33.4	29.6	125	7.5
Femur	14	57.0	50.1	44.9	127	7.6
Tibiotarsus	15	98.7	82.8	72.0	137	11.2
Tarsometatarsus	9	43.6	36.6	31.1	140	11.4

[1] Lengths are measured as follows: coracoid from head (lateral to furcular facet) to sternal facet (lateral to internal distal angle); humerus, from head to internal condyle; ulna, from intercotylar ridge to internal condyle; carpometacarpus, from external crest of trochlea to distal end of metacarpal 2; tibiotarsus, from proximal articular surface to distal end; radius, femur and tarsometatarsus, greatest length.

TABLE III

Estimated Size Range (in millimeters) of Specimens of

Mancalla diegense and *M. milleri*

Element	*M. diegense*			*M. milleri*		
	Max.	Mean	Min.	Max.	Mean	Min.
Scapula						
Breadth articular end	14.4	13.5	12.5	11.8	10.9	10.3
Coracoid						
Length	54.0	49.1	47.5	43.5	40.0	38.5
Breadth below furcular facet	6.3	5.8	5.4	5.1	4.9	4.0
Humerus						
Length	85.2	76.5	71.0	66.6	62.7	56.4
Breadth proximal end	20.3	18.7	17.3	16.4	15.3	14.2
Ulna						
Length	32.1	29.4	28.0	27.0	25.3	23.6
Breadth proximal cotylae	6.6	6.4	5.9	5.7	5.2	4.5
Radius						
Length	31.8	30.9	29.6	26.9	25.1	24.2
Greatest depth shaft	6.4	6.35	6.3	5.6	4.9	4.6
Carpometacarpus						
Length	37.2	35.6	35.0	33.2	31.6	29.6
Depth proximal end through metacarpal I	11.0	10.3	9.7	9.5	9.1	8.8
Femur						
Length	57.0	55.2	53.8	51.1	47.9	45.0
Breadth distal end	~~10.7~~ 11.1	10.2	9.57	9.3	9.0	8.4
Tibiotarsus						
Length	98.5	90.2	81.0	77.5	74.9	72.0
Breadth distal end	10.7	9.0	8.2	7.9	7.2	6.5
Tarsometatarsus						
Length	43.6	39.9	36.01	36.0	34.0	31.1
Breadth proximal end	10.7	9.6	8.7	8.4	8.0	7.2

TABLE IV

Qualitative Characters

Distinguishing Mancalla diegense and M. milleri

Mancalla diegense	Mancalla milleri
Coracoid: anterior edge of furcular facet projected anteriorly; tip raised slightly and gradually.	Coracoid: anterior edge of furcular facet nearly on line with anterior contour of triosseal canal; tip upswept anteriorly, with abruptly raised high, pointed tip.
Humerus: distal contour of bicipital crest (viewed anconally) almost a right angle, with prominent ligamental attachment at base of bicipital crest.	Humerus: distal contour of bicipital crest less angular, and ligamental attachment less projected
Ulna: Olecranon blunt, and straight with respect to shaft contour (in lateral view); very faint depression internal to olecranon.	Ulna: olecranon as in M. diegense but internal depression deeper.
Femur: obturator ridge relatively short, with generally rounded contour; very slight depression internal to ridge.	Femur: obturator ridge relatively long, with angular contour sharply defined by deep depression along internal edge of ridge.
Tibiotarsus: posterior contour of proximal articular surface with deep notch separating the external and internal portions of surface.	Tibiotarsus: slight indentation between external and internal portions of proximal articular surface, but no deep separation.
Tarsometatarsus: Viewed anteriorly, proximal end flared; external border of shaft sharper than internal; shaft moderately depressed.	Tarsometatarsus: Bone columnar in appearance; both borders of shaft (anteriorly) sharply defined; shaft well depressed anteriorly.

Muscle scar + depression below pneumatic fossa usually poorly defined.

Deep V-shaped depression below pneumatic fossa, bordered internally by well marked muscle scar.

Legend for Figure

Figure 1: A - C *Mancalla milleri* sp. n., A. Type femur (LACM 2185) posterior view; B. type femur anterior view; paratype humerus (LACM 2813) anconal view. D. *Mancalla diegense* Miller, maximum available humerus (LACM 2670) for comparison with *M. milleri*.

Los Angeles County Museum of Natural History Photos

Footnote 1 (manuscript page 1)

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New Light on the Extinct Family Mancallidae

By
Hildegarde Howard

Historical Background

The genus Mancalla was established by Lucas (1901) on the basis of a single humerus, lacking the distal condyles, represent- a flightless bird related to the auks. Over forty years later, with a complete humerus at hand from another site, Miller (1946:34) concluded that there was sufficient difference between the extinct bird and the alcids to warrant family separation. The family Mancallidae was established.

Published records of Mancalla have come from three main areas in southern California: the Third Street tunnel, Los Angeles (now considered of early Pliocene age), whence came the original type humerus of Mancalla californiensis; a roadcut on highway near Corona del Mar, Orange County (of early or early middle Pliocene age); and several localities in the town of San Diego, all seemingly within the San Diego formation which is now placed in the late Pliocene. By far the largest representation was recorded from the San Diego localities, where a preponderance of individuals of considerably smaller size than those found at the other two areas suggest the presence of a second species. To this smaller species the name Mancalla diegense was applied, the type of which was a femur previously described as Pliolunda diegense; the genus Pliolunda passed into synonymy (see Miller and Howard, 1949:204 and 222) The Corona del Mar material was assigned to M. californiensis. As more specimens were acquired from San Diego, the possibility was entertained that this species as well as M. diegense occurred at San Diego. Loye Miller and I presented a paper for the Cooper

Society annual meeting of 1950 on this subject, demonstrating the great range in size to be found in the bones from San Diego, particularly in the series of humeri. At that time we had only eleven humeri. The collections from San Diego have been greatly enlarged since that time. Several specimens of Mancalla have been added also from the Corona del Mar deposits since previous recording (Howard, 1949).

Late in 1964 an entirely new site was discovered in Orange County, near the town of El Toro. On the basis of the fish fauna, and the presence of a desmostylian sea mammal, evidence for a Miocene age for this site, is very strong. Over one hundred identifiable bones of birds are represented in the collections from this new site, including five fragments that resemble in many respects comparable elements of Mancalla. These five fragments have been carefully compared with specimens from Corona del Mar and San Diego. And at the same time the material from the latter two localities has been reanalyzed on the basis of the additional material now available. The resulting conclusions form the basis of the present report.

El Toro Material

The Mancalla-like bones from El Toro consist of a distal end of humerus with portion of shaft, two proximal ends of carpometacarpi, a portion of a coracoid and an articular end of scapula. All except the scapula could be compared with specimens of the same elements from both San Diego and Corona del Mar (the scapula has not been found at the latter site). The outstanding peculiarities of Mancalla are, of course, related to the adaptation of the wings for swimming rather than for flying. The large collection from San Diego provided sufficient material for a mounted skeleton and the wing is found to be markedly flattened and paddlelike. In this adaptational respect it is intermediate between the Great Auk and the penguins.

Measure br + depth shaft humerus El Toro vs type Mancalla + San Diego + coronoid area

The humerus from El Toro resembles that of Mancalla as distinguished from those of typical alcids (including the Great Auk) in the straightness of the shaft towards the distal end, and the marked lateral compression of the distal condyles; in the alcids the bone curves forward at the distal end and the condyles are more widely spaced, even in the flightless Great Auk. The humerus from El Toro, however, has one marked difference from those of Mancalla: the shaft above the compressed condyles is much rounder. In Mancalla the shaft is very narrow transversely and very deep anteroposteriorly; in the El Toro bone it is more nearly equal in the two dimensions. This rounded shaft suggests that this bird was less advanced in development of a flat, paddle like wing for swimming than was typical Mancalla.

The carpometacarpus of Mancalla differs from that of the alcids in having a longer, straighter process of metacarpal 1 and a low and narrow trochlear crest. These characters in the El Toro carpometacarpi agree with Mancalla but are developed to a lesser degree: the process of metacarpal 1 is relatively shorter, the trochlear crest less compressed relatively broader

	El Toro	Mancalla	Gr. Auk	Uria
Relative length Mi to depth prox. end	116.5 %	136.6-149.5	86.7-93	70-74
Br. trochlea to depth prox. end through Mi	43 %	40 - 42	44-46	49-50

The most marked distinction between the El Toro bones and those of Mancalla lies in the presence of a small, pisiform process on the internal surface of the El Toro carpometacarpi in the former which is completely lacking in Mancalla. lies in the complete absence of a pisiform process in the former, whereas it is still present, but reduced in the latter.

Like the humerus, the carpometacarpus of the El Toro bird is less advanced towards development of a strictly paddle-like wing. Distinctive characters also appear in the coracoid but in this fragment, they are less significant as evidence of adaptive differences.

Comparison of the Corona del Mar material with that from San Diego reveals differences of ~~sufficient degree to warrant~~ specific separation. The birds from both of these sites, ~~however,~~ had ~~a~~ markedly paddlelike wing and would be considered as typical of the genus Mancalla. ~~The more markedly distinctive characters of the El Toro bird (which seem to be of evolutionary significance) therefore, seem to me to indicate generic separation. at the generic level.~~

As before noted, the Corona del Mar material has been assigned to Mancalla californiensis. There seems to be no reason to alter this conclusion now. But the possibility that at least the larger specimens from San Diego are the same as those from Corona del Mar and therefore also represent M. californiensis, can no longer be maintained. In the most diagnostic elements the Corona del Mar bird shows small, but clearly distinguishable differences from both large and small specimens of the San Diego representation. These are evident not only in the humerus (of which, though there are many specimens from San Diego, there is but one proximal and one distal end from Corona del Mar), but are even more notable in the carpometacarpus (of which, fortunately, there are three good specimens from Corona del Mar and ten from San Diego, so that allowance for variability can be taken into account. Differences are also observable in the coracoids, although only one fragment of this element has come from Corona del Mar.

How shall we evaluate the San Diego material? The great range in size previously noted has become even more notable with the additional material now at hand. In the coracoid and humerus, for example the maximum specimens are 50 - 51 % larger than the miniumu; in the tarsometatarsus, ~~40~~ 40 %, radius, ulna and tibiotarsus, 31-38%,

If the large specimens from San Diego are not to be assigned to M. californiensis, how shall we evaluate the San Diego collections? The great range in size previously noted has become even more marked with the additional material now at hand. The possibility that this range might be influenced by inclusion of bones of both immature and fully adult birds was dismissed on evidence of the tibiotarsus. In this element length can be measured on 14 specimens. The bridge across the tendinal canal is ossified and present in six of nine small specimens (that measure 71-78 mm. in length and 7.5-7.8 mm. in breadth of distal end) but is lacking in all five of the large specimens (ranging from 91-98 mm. in length and 8.7-9.7 in distal breadth). Obviously the smaller bones, with ossified bridge are not younger than the large bones lacking the bridge.

There seems no other alternative than to assume that two species are presented in the San Diego material. In the best represented element, the humerus, a linear dimension can now be taken on 38 specimens and a measurement of breadth of proximal end on 63. The size range is from 56.4 - 85.2 mm. in length, the maximum bone being 51 % greater than the minimum. In a very much larger series of humeri of the Great Auk recorded by Lucas (1888) the maximum exceeds the minimum by 18%, and in a smaller series of Murre bones, the difference is only 10%. Furthermore in the large series of Mancalla humeri there is an interval of 3.5 mm. in length between 50 specimens ranging in size from 39.5-66.6 mm., and a smaller series of 13 bones ranging from 70.9 - 85.2 mm. an interval of 1 mm. occurs, as well at the same point as the linear break in the breadth of proximal end, in view of the fact that only 3 intervals in proximal breadth .1 mm. occur below this break among the small specimens, There are two bones of intermediate size, closest in length to the small specimens, but as broad as the longer bones, that have the bridge in tact. It is my belief that these could represent large males of the small species.

I now feel convinced that two species are represented. One of these, we have seen, bears the name Mancalla diegense, The other is not Mancalla californiensis and will require description. At this point, however, we

I now am convinced that two species are represented. As M. californiensis is not included, a new species must be described. At this point, however, studies of the San Diego material reveal a surprising fact. The type femur of Mancalla (previously Pliolunda) diegense

Now that
Most of
The additional femora that have been discovered since the 1949 recording are markedly smaller than these previously recorded, the minimum specimen measuring xxxx approximately 43 mm., 16 mm. less than the type of M. (Pliolunda) diegense

For the most part, the additional emora that have been discovered xxxxxxxxxxxxxxxxxxxx are smaller than those for which measurements were available adn recorded in 1949. xxxxxxxxxxxxxxxxxxxx The result is a series of fifteen specimens for which xxxxxxx length can be at least estimated, the type of Mancalla diegense (previously Pliolunda) is the largest of all and is 30% larger than the xxxxxxxspecimen on which a dependable linear dimension can be taken. Consequently, it becomes necessary now to recognize M diegense as a species equal in size to M. californiensis, but different in certain characters, and the small dominant species of the San Diego formation must now be named.

128

44.8) 580
448
1320
896
4240
32

To summarize the results of this somewhat complicated study:

1. A species less highly adapted to swimming than Mancalla, but otherwise showing characteristics that link it with Mancalla rather than with any member of the Alcidae, has been found in deposits of probably Upper Miocene age, but certainly earlier than those from which Mancalla has previously been known.
2. The characteristics of this earlier form strengthen the case for separation of the Mancallidae as a family from the Alcidae.
3. A new genus of Mancallidae will be established on the basis of the earlier material.
4. The Corona del Mar representation of Mancalla, assigned to M. californiensis, can now be distinguished from specimens of comparable size from San Diego. Hence the species M. californiensis as now known is limited to two localities, the type 3rd st. tunnel deposits, and Corona del Mar.
5. The great range in size in specimens of Mancalla from San Diego is emphasized by additional material, and the femur which forms the type of M. diegense now proves to be of maximum size for this locality. Hence the larger San Diego species must now be known as M. diegense. The small, much more abundant species will require renaming.

Type
Diagnosis:/Humerus 37 per cent smaller than type of Mancalla californiensis, and 48 per cent smaller than maximum humerus from San Diego now assigned to M. diegense; paratype coracoid and carpometa carpus 34 and 25 per cent smaller respectively than comparable elements of maximum size of M. diegense. Series of humeri

Diagnosis: A smaller species than M. californiensis or M. diegense. In series, individual elements averaging 14 to 23 per cent smaller than comparable series of elements/of M. diegense.

Mancalla californiensis Lucas

Except for the humerus, the following amended diagnosis is based on skeletal elements from the Pliocene of the Newport Bay Mesa area near Corona del Mar, Orange County, California. Available specimens are as follows: humerus, proximal and distal ends of two individuals (LACM nos. 2576 and 2577); carpometacarpus, 1 complete, 2 proximal halves (LACM nos. 2578, 2033, ~~2583~~ and 2625); coracoid, 1 upper half (LACM no. 2581); ulna, 1 incomplete (LACM no. 2580); radius 1 practically complete (LACM no. 2579); tarsometatarsus, 1 nearly complete, 2 incomplete (LACM nos. 2250 and 2034 (2)). As the characters of the proximal end of the humerus from Corona del Mar agree with those of the type incomplete humerus of M. californiensis, and the size is compatible, the birds from these two localities are believed to be conspecific. Complete confirmation of the assignment of the Corona del Mar material to M. californiensis can be hoped for only if other elements (particularly the very diagnostit carpometacarpus) should be forthcoming from the type locality. Diagnosis is confined to characters at the specific level; detailed characters pertaining to the genus Mancalla have been discussed at length in a previous publication (Miller and Howard, 1949).

Amended diagnosis: Humerus with muscle attachment below the pneumatic fossa forming an elongated groove with ridgelike edges running up proximally into the fossa beside the median partition; distally, attachment between ectepicondylar process and external condyle (palmar surface) more prominent than in M. diegense, but ectepicondylar process generally less prominent than in that species.

Coracoid: furcular facet relatively shallow proximodistally, ridge of shaft (viewed internally) running medial to anterior edge of furcular facet; head less narrowed in middle when viewed proximally, than in. M. diegense.

Genus Mancalla

The general characters of the individual elements of Mancalla described by Miller and Howard (1949) are still substantially characteristic of the genus. Deviations at the specific level now require clarification. ~~Amended~~ Augmented diagnoses of the species M. californiensis and M. diegense are presented in tabular form, and a third species is described.

Miller and Howard (1949:225) and Miller (1956:618) noted that ~~two species of Mancalla were probably present in the Pliocene of San Diego~~. The larger of these, and the specimens collected near Corona del Mar, were presumed to represent Mancalla californiensis. The smaller, more abundant species, found only in the San Diego deposits, was called Mancalla diegense, the type being a femur from San Diego, originally described as Pliolunda diegense (see Miller ad Howad, loc. cit.). The assignment of the Corona del Mar bird to M. californiensis seems justifiable now that a proximal end of humerus can be compared with the type humerus of this species from Los Angeles. The two bones are markedly alike in qualitative characters as well as size. Complete confirmation of the assignment, however, can only be hoped for if other elements (particularly the more diagnostic carpometacarpus) should be forthcoming from the type locality in Los Angeles.

The San Diego humeri differ in certain respects from the type of M. californiensis, and the carpometacarpi and coracoids are even more markedly distinguishable from these elemtns in the Corona del Mar collections. None of the San Dieto specimens should, therefore, now be identified as M. californiensis.

Insert table of comparison of later

M. californiensis and M. diegense

Coracoid with coracohumeral surface narrow and twisted so that uppermost edge is directed slightlyanteriorly, glenoid facet somewhat convex and tending to slant towards anterior face of bone at upper end; sternal end (not observed in Praemancalla) relatively straight with narrow sternal facet, contrasted with Alcidae in which sternal facet widens inte nally and internal angle bends posteriorly.

Scapula with acromium rising gradually from shaft with practically no anterior projection; glenoid facet convex, united with ball-like coracoidal facet with only a deep indentation of anterior contour suggesting separation of the two facets; blade thick.

~~Mancalla californiensis and M. diegense~~

~~It has been previously noted~~ (Miller and Howard, 1949:225) and Miller, 1956:618) that two species of Mancalla were probably present in the Pliocene of San Diego. The larger of these, and the specimens collected near Corona del Mar, were presumed to represent Mancalla californiensis. The smaller, more abundant species, found only in the San Diego deposits, ~~has been known as~~ Mancalla diegense, the type being a femur from San Diego, originally described as Pliolunda diegense (see Miller and Howard, loc. cit.). The assignmnet of the Corona del Mar bird to M. californiensis seems justifiable now that a proximal end of humerus can be compared with the type humerus from Los Angeles. The two bones are markedly alike in ~~both~~ qualitative characters as well as size. Complete confirmation of the assignment, however, can only be hoped for if other elements (particularly the more diagnostic carpometacarpus) should be forthcoming from the type locality.

The San Diego humeri differ in certain respects from the type of M. californiensis, and the carpometacarpi and coracoids are even more markedly distinguishable from these elements in the Corona del

Mar collections. None of the San Diego specimens should now, therefore, be identified as M. californiensis.

The size range in the San Diego material, previously noted, has become even more marked with the additional material now at hand. It seems highly improbable that a single species could encompass so great a range in size. The former supposition that two species are represented at San Diego now becomes a certainty, and it becomes necessary to describe a new species. However, it is not the larger form, previously tentatively assigned to M. californiensis, that must be named, but the smaller bird that is the dominant form at San Diego.

When the species Pliolunda diegense was originally described (Miller, 1937:376) the femur which forms its type was believed to have belonged to a bird of smaller size than Mancalla californiensis. Even when the genus Pliolunda was synonymized with Mancalla (Miller and Howard, 1949:225), there seemed no reason to doubt that it represented the dominant form of the San Diego formation. At that time there were only thirteen specimens of the femur known, and only four of these were complete. There are now 35 femora available from San Diego, and lengths can be measured, or reasonably estimated on fourteen of these, and breadth of proximal and/or distal end on an additional ten specimens. Sixteen of these measurable specimens may be assigned to the smaller form, 8 to the larger. The type of M. diegense is one of the three largest (both in length and breadth) in the latter group, and is more than 30 per cent larger, both in length and breadth than the minimum dimensions for the smaller series. It becomes necessary, therefore, to recognize the larger San Diego form as M. diegense and to name the smaller, dominant form.

OVER

not a neotin
only a negative site ~~xx~~ The occurrence of two
contemporaneous subspecies made ~~is~~ not impossible.
~~Unlikely~~ is doubtful

~~Unless The collection represents~~

Possibly the S.D. deposits represent a wider
time span than ~~was~~ was believed at the time
of excavation. It is less likely that two (lightly) subsp
occurred ~~contemporaneously~~ at the site. Area
~~subjection~~ study of living penguin subsp. might
throw some light on this question. At the
present stage of knowledge it seems advisable
~~to~~ describe the small form at the specific level,

These observations serve to enlarge the concept of the differentiation of the Mancallidae from the Alcidae and suggest the advisability of establishing an amended diagnosis for the extinct family. When originally described, the family (Miller, 1946) was known only from the humerus of Mancalla, and M. californiensis Lucas was the only species recognized.

The general characters of the individual elements of Mancalla described by Miller and Howard (1949) are still substantially characteristic of the genus. Deviations at the specific level now require clarification. Amended diagnoses of the ~~two previously known~~ species, M. californiensis and M. diegense are presented in ~~xxx xxxxxxx~~ tabular form, and a third species is described.

Family Mancallidae

The following amended diagnosis of the family Mancallidae is based on only those elements that have been observed in both Praemancalla and Mancalla, namely: coracoid, humerus, carpometacarpus and scapula.

Humerus compressed, external condyle markedly palmad with respect to internal condyle, tricipital grooves deep, external ridge of grooves reduced relative to internal and median ridges; ectepicondylar process extended well above external condyle; anconal contour of distal end of shaft straight or slightly falred anconally, not recedin palmad as in the Alcidae.

Carpometacarpus with trochlear crests low, contrasted with Alcidae in which they extend well above the process of metacarpal 1; trochlea compressed, narrower posteriorly than proximally, process of M1 straight and greatly exceeding in length the depth of the proximal end; facet for digit 1 narrow.

Table 1

Length of

Size Range and Variability in Limb Elements of Mancalla

From the San Diego Pliocene

	Max.	min.	mean	no. of specs.	Var.	max. % of min.
Coracoid	56.0	39.0	44.7	19	11.9	143
Scapula	13.2	10.2	11.3	11	9.7	129
Humerus[a]	85.2	56.4	66.1	30	10.2	151
Ulna	33.1	24.2	27.0	19	8.2	136
Radius	31.7	24.2	27.5	7	10.2	131
Carpometacarpus	37.1	29.6	33.6	10	7.4	125
Femur[b]	58.0	46.8	47.0	7	9.6	124
Tibiotarsus[c]	98.7	71.5	82.4	14	11.2	138
Tarsometatarsus	43.6	31.1	36.1	8	9.8	140

---

[a] In Pinguinus maximum 114 per cent of minimum; coefficient of var. 3.0

[b] In Pinguinus " 123 " " " " " " " " 3.6

[c] In Pinguinus " 117 " " " " " " " " 2.0

$V = \frac{100s}{\bar{X}}$ the standard deviation of the sample (= 100s) divided by the mean of the sample ($= \bar{X}$)

To find s first find s^2 as follows:

Sum of squares of each length (= sum of frequency $\times x^2$)

Minus sum of each length squared divided by N

Then divide this result by N − 1

$$s^2 = \frac{\Sigma x^2 - \frac{(\Sigma x)^2}{N}}{N-1}$$

$s = \sqrt{s^2}$ and $V = \frac{100s}{\bar{X}}$ (= mean of sample)

Table 2

Size Range and Variability in Length of Limb Elements of Mancalla from the San Diego Pliocene, when divided into two groups

	max.	min.	mean	no. spec.	var.	max % of min
Coracoid						
Large	56.+	48.5	50.4	8	4.9	115 ok
Small	44.8	~~37.3~~ 39.0	~~40.5~~	~~12~~ 11	4.0	115 ok
Scapula						
Large	13.2	11.8?		4		
Small	10.2	10.3	(11.3)	6		
Humerus						
Large	85.2	71.0	76.5	7	6.5 4.0	120 ok
Small	66.6	56.4	62.7	23	~~7.13~~	~~120~~ 118
Ulna						
Large	33.1	~~28.5~~ 29.9	31.0	~~8~~ 3	5.78	110 ok
Small	~~27.4~~ 28.7	~~24.8 (2)~~ 24.2	26.3	~~14~~ 16	5.0	115 ok
Radius						
Large	31.7	29.5	30.5	3	3.6	107
Small	~~25.8~~ 27.0	24.2	25.3	4	4.7	111 90
Carpometacarpus						
Large	37.1	35.0	35.8	5	2.1	106
Small	33.0	29.6	31.5	5	4.4	111
Femur (distance od to centrum)	~~44.8~~					
Large	~~56.3~~ 53.1	~~50.4~~ 52.8	52.8	2? 3		101
Small	~~47.3~~ 48.5	~~44.8~~ 42.6	44.8	5 3	4.8	~~118~~
Tibiotarsus						
Large	98.7	91.4	93.6	5	3.0	108
Small	71.5	82.2	76.1	9	4.7 ok	115 ok
Tarsometatarsus						
Large	~~43.6~~ 41.9	~~39.3~~				
Small	~~31.1~~ 30.0	~~37.0~~ 35.0		1		
	38.3	31.1	35.0	7	7.2	123

On the basis of the Mancalla material, the San Diego, Laguna Hills, Humboldt County and Cedros Island deposits appear to be closer in age to each other than to the Corona del Mar and Third Street Tunnel occurrences.

omit?

Mar 1, 1958

GEOLOGIC DISTRIBUTION

The genus Mancalla is essentially associated with the Pliocene although its exact extent throuout that epoch is not yet clear. The Third Street Tunnel site (type locality of the genotype Mancalla californiensis, Lucas) has been called "Lower Pliocene" (Arnold, 1907), or "Middle Pliocene" (Soper and Grant, 1932). The Corona del Mar site was judged "late Lower Pliocene" (Howard, 1946), and the San Diego Formation was recorded as "Middle Pliocene (Hertlein and Grant, 1944).

The age of the Cedros Island beds has been analyzed by Dr. Frank Kilmer, Chairman of the Department of Geology, Humboldt State College, and member of the UCR expedition to Cedros. In a personal communication he states that the beds in which Mancalla occurred have yielded no invertebrate fossils, but their position -- resting on beds of late Miocene age and underlying invertebrate-bearing beds of probably mid-Pliocene age -- at least provides the limits ~~to their~~ of possible age, and suggests an early Pliocene position.

The possible extent of the genus into late Pliocene or even very early Pleistocene has been ~~lately~~ suggested by Allison's (1964) report of the occurrence of a single horse tooth, identified as "Equus" in the San Diego Formation. Regarding the Humboldt County occurrence, Mr. Roy Kohl, who collected the Mancalla bone with bones of other birds at the Crannell site, believes the deposits there are of late Pleistocene age. And certainly the other bird bones that I examined would confirm this assignment. However, the possibility of redeposition from the late Pliocene Moonstone Formation not too far distant should not be overlooked. Bones of Mancalla from the Pliocene beds in the Upper Newport Bay area have been redeposited in late Pleistocene Newport Bay Mesa sediments. In this case, however, preservation in the two formations is so distinct that the redeposited bones are easily detected.

Done

The age of the Laguna Hills beds (LACM locs. 65120 and 65121) has not been definitely established. The other Laguna Hills site (LACM loc. 1945), the type locality of the more primitive Praemancalla, is estimated as of late Miocene age (Howard, 1968). It is downhill and across Aliso Canyon from the site of the Mancalla bones. No megafossil invertebrates nor foraminifera are available to aid in correlation. Preservation of the bird bones and the avian species content differs, however, at the two sites. The presence of Mancalla in 65120 and 65121 suggests a Pliocene age for these deposits.

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The fortunate diesovery of Manealla on Cedros Island affords a means of checking the expected size range of M. diegense. Compared with the San Diego collection, the Cedros Island sample appears to be homogeneous. Where two or more specimens of an element are available the ratio of maximum to minimum never exeeeds 114% and the coefficient of variability is from 4.4 to 6.6. When distributional curves are drawn for the San Diego material, the Cedros Island bones are consistentlŷ above the more abundant group of small individuals The single coracoid and tibiotarsus from Cedros fall midway between the small and large groupings. On the other hand the maximum scapula, ulna, radisu, carpometacarpus, femur and tarsometatarsus from Cedros are close to the maximum measurement of these elements from San Diego. The two humeri are about 6 mm above the maximum of the small group, and a third incomplete humerus with broader proximal end suggests extension of the range well beyond this point.

Although there are some differences in contours between the Cedros bones and M. diegense in certain elements (enough to justify description of the island material), the two species must have been close in size. The distributional curves of the elements from San Diego are interpreted with this supposition in mind and a tentative size range for M. diegense is as follows; coracoid (length to middle of sternal facet) 45-56 mm.; scapula (breadth of articular end) 12-14 mm; humerus (length to internal condyle) 71-85 mm; ulna (length from intercotylar ridge to internal condyle) 28-32 mm; radius (greatest length) 28 - 32 mm; carpometacarpus (length to distal end of M 2) 35 - 37 mm; femur 48.5 - 53.5 mm; tibiotarsus (length to proximal articulation) 81-98.5 ; tarsometatarsus (greatest length) 37- 43.5 mm.

With the exception of two ulnae, all the specimens from Laguna Hills localitities 65120 and 65121 fall within the size range of M. diegense and are so assigned, as they cannot be distinguished on qualtitaive characters;

June 25, 1962

TABLE I

Comparison of Mancalla bones from Corona del Mar and San Diego

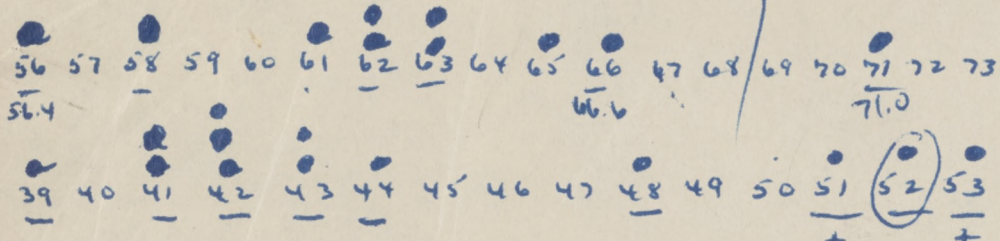
Element	Corona del Mar	San Diego
Coracoid		
Anterior border of triosseal canal	Posterior to tip of furcular facet	On line with tip of furcular facet and forming anterior border of coracoid
Upper surface of head	Broad and smoothly rounded	Narrowed on both sides of a central ridge
Tip of furcular facet	Blunt and lacking up-turned point	With up-turned point
Ulna		
Intermuscular line below cotylae	Desdending in straight line to internal edge of shaft, 4.3 mm above distal end; jutting back mediad to end in longitudinal ridge (3mm long) at internal edge of palmar surface of shaft above distal end	Descending in broad curve to internal edge of shaft; return from edge negligible.
Area between olecranon and cotylae	Shallow depression with ridge nearly on a line with intercotylar ridge	Deeper depression, with ridge well internal to intercotylar ridge.
Palmar side of shaft above distal end	Flat and bordered by well-marked intermuscular lines	Slightly rounded and slanting off from internal to external side
Radius		
External surface	Smooth, lacking depression below head	Generally rugose, with marked depression below head.
Concave (median) surface of distal end	gently convex	Unevenly rugose
Carpometacarpus		
Size	Length (1 complete) 41.3mm Length process of M 1 (4 specimens) 16.6-17.4	~~Length (maximum)~~ 37.1mm; (maximum of 2 specimens) Length process of M1 15.4. ~~maximum~~
Internal trochlear crest	Not clearly demarcated from M 3	Clear indentation separating base of crest from M 3
Tibiotarsus		
Proximo-internal ligamental attachment	Short, broad, flat and partly on posterior surface of shaft	Long, thin, straight ridge along internal edge of shaft
Tarsometatarsus		
Anterior face of shaft	Faintly depressed immediately proximal to distal foramen; above this, shaft level or tending to convexity. External border of shaft indistinctly raised	Marked groove extending proximally from distal foramen along external part of shaft; external border of shaft raised for full length of shaft

to the type) LHM 2220, tibiotarsi LACM 2125 and LHM 2270 and 2294, tibiotarsus and tarsometatarsus (found together), LACM 2177, tarsometatarsus LACM 2178. The other specimens now assigned are: 3 scapulae, 12 coracoids, 21 humeri, 5 ulnae, 4 radii, 6 carpometacarpi, 7 femora, 16 tibiotarsi and 5 tarsometatarsi. Five of these newly assigned bones bear LHM numbers, 10 UCMP, 3 SDSC, and the remainder LACM. Skull parts, sterna and pelves are too poorly preserved to make definite identification. However, one sternal fragment (LACM 2333) and one cranium with associated rostrum (LACM 2633) appear to be larger than other specimens and are tentatively assigned to M. diegense.

The humerus from Humboldt County conforms in all respects with humeri of M. diegense and is so assigned. Its measurements are as follows: length to internal condyle 81.3 mm, breadth of proximal end 19.5 mm, breadth of distal end 7.0 mm.

The specimens from Laguna Hills are poorly preserved. They are, however, clearly distinct from the bones of M. californiensis found at Corona del Mar and appear to resemble those of M. diegense. They are tentatively so assigned.

Humerus



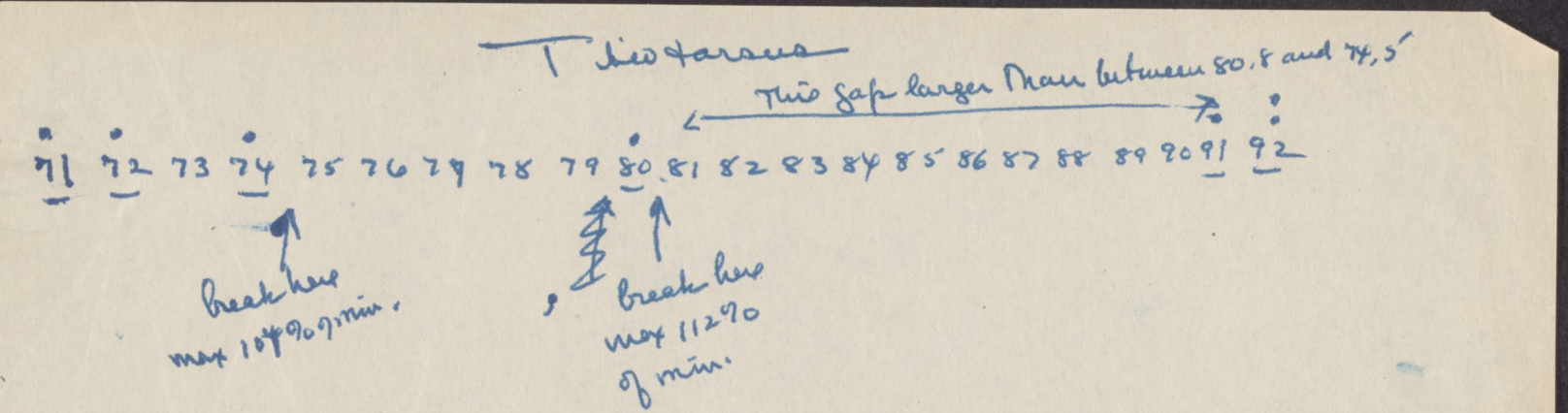
— 22.3 mm from 56.4 78.7

over all length

length to end deltoid crest

○ = these are same index.

+ = added, one all not available


T tibiotarsus
This gap larger than between 80.8 and 74.5
71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92
break here
max 104 90 9 min.
break here
max 112 90
0 min.

Coracoid

39 40 41 42 43 44 45 46 47 48 49 50 51

39.2

42.1

48.7

51.7

Mancalla milleri new species

TYPE: Complete left humerus, LACM no. 2813; collected by

date.

Lacality and age: LACM loc. no. 1071

San Diego, California; San Diego Formation, late Pliocene.

Paratypes: Complete right coracoid, LACM no. 2229, collected by Geo. Kanakoff, May 12, 1948 at loc. 1080

1 complete left carpometacarpus, LACM no. 2068 collected by

date from locality

Referred material from the San Diego formation: 22 complete humeri, nos. LACM 2206, 2096 (2), 2303, 2219, 2292, 2504, 2553, 2480 (3) 2827, 2326, 2679, 2850, 2824, UCMP 45842, 45845, UCLA 2281, 2216, 2269, 2218; 10 complete coracoids, LACM 2243, 2557, 2276, 2627, 2208, 2559, 2498, # ? , UCMP 45843, 45844; 4 complete carpometacarpi, LACM 2825, UCLA 2281, UCMP 45842, 45862; 7 complete ulnae, 1LACM 2439, 2497, (2) 2082, 6426, 5926, 2552, /UCMP 45842; 3 complete radii, LACM 2632, UCLA 2270, UCMP 4582. Many other fragmentary specimens of small size are presumably referable as well.

Paratype coracoid and carpometacarpus each 82% of average for M. diegense. (6)

Diagnosis: A smaller species than M. californiensis or M. diegense; type humerus roughly 3/4 the size of the type of M. californiensis or and the average for M. diegense. In series, individual elements averaging 80 to 87 per cent of average of comparable elements of M. diegense. See Table 1 and 2.

Description: Although the separation of M. diegense and M. milleri is based largely on statistical evidence, there are a few qualitative characters that seemingly differ in the two species. It is difficult, however, to determine their reliability in diagnosis due to poor preservation of detailed contours and mottled coloration of most of the specimens, ~~however, make it difficult to determine the reliability of these characters in diagnosis.~~ The following characters appear to separate coracoid of M. milleri; with furcular facet higher and more attenuated (see Plate I) than in M. diegense; femur with suggestion of greater depression posterior to anteriorly along the trochanter and proximal contour straighter from trochanter to head; tibiotarsus with supratendinal bridge seemingly stronger, as nine specimens (five complete, four distal ends) in which the bridge is preserved fall within the size range characteristic of M. milleri; tarsometatarsus with more columnar shaft.

Possibly the ulna, radius & carpometacarpus are relatively longer in M. milleri than in M. diegense

Diagnosis: A smaller species than M. californiensis or M. diegense; type humerus 27 37 per cent shorter from head to end of deltoid crest and 25 31 per narrower in breadth of proximal end than type of M. californiensis and 25 22 per cent shorter in greatest length and 23 29 per cent narrower in breadth of proximal end than ~~xxx~~ the average of M. diegense

Comparison of sizes of limb elements of Mancalla at San Diego, Laguna Hills, Corona del Mar, Cedros Id.

	San Diego	Corona del Mar	Laguna Hills	Cedros Id.
Coracoid				
Humerus	70.9 – 85.3 L 58.2 – 66.4 S 17.3 – 20.3 prox L 14.2 – 16.4 " S	18.5 prox	—	72.1 (2) 17.0 – 18.5 prox (5)
Ulna	28.5 – 33.1 (8) 6.1 – 6.4 24.2 – 27.8 (15) 4.9 – 5.6 prox	6.6 prox (1)	29.7 – 30.5 (6) 6.0 – 6.5 (prox) 26.2 – 26.8 (2) 5.4 – 5.6 prox	28.9 – 32.4 (10) 6.2 – 7.2 prox
Radius	29.5 – 31.7 (4) 6.1 – 6.6 " (5) 24.2 – 27.0 (5) 4.5 – 5.7 (3)	29.7 6.8 (prox)	—	– 28.0
Tibiotarsus	35.0 – 37.2 (7) 9.8 – 11.5 depth prox (6) 15.0 – 15.4 (MI) (4) 29.6 – 33.0 (5) 8.8 – 9.5 prox 12.5 – 14.5 MI	41.3 11.0 – 11.6 prox depth (3) 16.5 – 17.6 (MI)	None	34.8 – 35.7 (9) 10.2 – 10.5 prox depth 15.7 – 16.0 (MI) 15.7
Femur	—	—	—	54.6 – 56.2 (4)
Tarsus				37.3 – 42.0

2 3
1 39
3 62

Femora from Cedros

RHT 1297 = 65144 / 15425 – prox fem

RHT 1284 = 65144 – R + L femora

65146 / 15345 – dist R. femur

RHT 1296 = 65147 / 15373 – R + L femora (1 comp. 1 lacks dist end)

Tarsi from Cedros

RHT 1296 = 65147 / 15373 Top frag. of tarsus

RHT 1297 = 65144 / 15425 comp R tarsus 4

RHT 1283 = 65144 / 15427 tarsus in matrix

RHT 1284 65144 L tarsus complete 4

65151 / 15374 R tarsus 4

15375 dist ½ ?

65153 / 15402 dist tarsus

65148 / 15418 R dist tarsus

Definite/small

Coracoid 45843 (40.8—?) ✓
45844 (1 complete) 40 (40.4) (39.3)
0 thin sec
2627 (39.8, 39.2)
2229 (— 40.4)
25559 (41.5, 40.7)
25557 (40.5, 39.7) ?
2276 (39.4, 39.3)
2498 (—, 40.2)
2338 (40.0, 39.6)
mt 2208 (38.5—)
mt 2243 (41.4—)

?
46028
prob. hum?

Definite/large

coracoid 45863
2498
2067
2310
2422
2290
2849

July 31, 1969

Scapula 25536 (2) (10.2, 10.6)
2258 (10.9)
2297 (10.4)
2252 (10.3)
2536 (10.7)
45806 (11.7)
45882 11.6)
added 2070 (11.3)

added UCLA 2270 (2) (10.4, 10.8)
" 2345? (11.8) added

scap 2654 (13.1)
added UCLA 2345 (14.4)
2049 (12.1 to 1)
2178 12.9
45860 13.7 (1st meas. 1964 14.4)

Cedar 15410 (13.5

ulna 46424 (25.9, 26.5)
2497 (25.2, 256) (26.1, 26.8)
2552 (24.8, 25.3)
2439 (26.7, 27.3)
2082 (25.5, 26.1)
2342 (23.6, 24.2) mt
2179 25.3 int, 25.4 ?
UCLA 2345 (26.8, 27.2)
45519 (26.2, 26.6)
45853 (25.2, 25.4)

added
2079 (24.0—)
2484 (25.7—)
45842 (26.3, 26.6)
45844 (23.1, 23.5)

ulna 2064 (32.0, 33.0) ✗
2323 (28.8, 29.9) ✗
2336 (27.8, 28.2) eroded
2287 (28.7 to 28.0)
45859 (28.6, 28.7)

2544 (29.0)
unmeas (30.2

Radius 2632 (24.9)
45519 (24.0)
46030 (25.2)
45892 (24.2)
245 / 4) 983
mt 2335 (25.5)

Radius 2486 (29.6)
2812 (31.8)
46016 (30.4)
309 / 3) 918
2270 (27.0)

femur 2508 (44.4 intercond.)
1875 2848 (42.6 ") added
45851 (44.0)
024 (45.2)
139 (47.3)
253 (46.6)
5.0 Stats 2097 (48.5)
2185 (44.7)
UCLA 2345 (48.5)
UCLA 2270 (44.8 ~~?~~ ?) anchin middle

femur UCLA 2220 (51.4 intercond.)
Tyke 33409 (53.1)
dist fe 10.2
11.0

Calcaneus UCLA 2345 (31.0)
2281 (31.8)
2068 (29.7)
2825 32.8)
45862 (33.2)
45518 30.7 (juv.)
added 45842 (30.7)

calcaneus 2542 (35.5)
2541 (37.2)
2060 / 2545 (36.0)
2060 (35.0)
45861 (35.3

Tarsus 2548 (32.5)
2682 (31.1
2527 36.0
6454 35.8
2499 37

Tarsus 2178 43.7
? 48852 40+? check this ✓

Small

T chrà ✓2083 74.8

2088 (73.4) ✓2628 72.7

2209 ap. 71.6? ✓2286 77.3

2478 (76.5) ✓2549 76.7

2385 OLCM (76.9) 2134 78.2

Jaya

2308 92.9

2477 92

2530 82.2

2123 93.4

46015 (98.7)

2681 85 to 86 inc

Richard C. Lewontin

Unpublished? 7. 19.64

Mounted skeleton of Mancalla from San Diego Pliocene

Mancalla holds the important position in California paleontology of being the first fossil bird discovered in the state. From an incomplete humerus, recovered during the excavation of the 3rd St. tunnel in Los Angeles, Lucas (1901) named the species Mancalla californicus, and described it (op. cit., p. 134) as a flightless auk more completely adapted for subaquatic flight than the Great Auk, although the wings were not so extremely modified as those of penguins."

Subsequent discovereis of bones of Mancalla in San Diego and in a road cut near Corona del Mar, from 1933 to 1947 have been recorded by Miller and Howard (1949). The total reported at that time was 145. Continued search for bones of Mancalla has now raised this total to . The assemblage from San Diego comprises the bulk o the material, the LACM having 224 bones its collections when sel ection of specimens for a mount was begun.

Although there are many duplicate specimens of certain elements, the great variation in size allowed less freedom of choice than might be expected in selection for the mount. The few outstandingly large specimens in the collection suggested that two species may be re presented. This probability later received brief mention by Miller (1956). The large bones were set aside, and the choice for the mounted skeleton was made from the more abundant group of small specimens. In the pelvis and skull, however, the choice was actually limited to one good specimen each. The size of the aceta bulae of the pelvis suggested the proper size of the femora, and these in turn provided a key to size of the tibiotarsus. The specimen of the latter element was found with a tarsometatarsus, evidently of the same individual; these two bones were used (#2177). Later studies (1964, unpublished) indicate that these leg bones belong to the smaller species, although the tarsometatarsus is of medium size with respect to others in the collection. Of two avail able sterna, both were of a size which appeared to correlate with the pelvis. Coracoid size was gauged by fit into the coracoidal sulci of the sternum. Measurements of coracoids used (complete no. 2143) indicate medium size within the small group. The humeri selected were two of four elements all much of a size. Except for medium size, there is no other means of correlating this element with the body skeleton. Fortunately the single skull and single

pelvis appear to represent birds of medium size, and therefore choice of medium-sized limb elements seemed logical. No ribs and only a few vertebrae were available. Rather than to model these parts, the bones of a California Murre (Uria aalge californica) of comparable size were used. Body size of the Murre, as indicated by sternal breadth was previously shown to be similar to Mancalla (Miller and Howard, 1949, p 207). Furthermore the vertebrae of Uria a. calif. LACM specimen no. BI 507 were found to correspond satisfactorily in size to the one cervical, one thoracic and 1st synsacral vertebra (attached to the pelvis) as found among the fossil elements. The lower mandible of this same specimen (507) could also be used.

Following is a list of specimens sleected:

Femur	Left	2097 complete		Right ?	proximal ¾
Tibiotarsus	"	2210 distal		"	2177 complete
Tarsometatarsus		2245		"	2177 complete
pelvis		2182			
Sternum		2063			
Skull		2205			
Coracoid	Left	2208 incomplete		Right	2243 complete
Scapula	L. ¾ of bone preserved ?,			R. ½ bone preserved, ?	
Humerus	Left	2303 complete		Right	2442 complete both 63.8mm.
Ulna	"	2544		"	2543
Radius	"	2335		"	plaster cast
Carpometacarpus	Left 2213, other one unnumbered				

From earlier notes → Copy sent to MacDonald June 1964

Mounted skeleton of Mancalla from San Diego Pliocene

The LACM had 224 bones of Mancalla from San Diego when selection of specimens for a mount was begun

Although there are many duplicate specimens of certain elements, the great variation in size allowed less freedom of choice than might be expected in selection for the mount. The few outstandingly large specimens in the collection were set aside (as possibly representing a separate species) and the choice for the mounted skeleton was made from the more abundant group of small specimens. In the pelvis and skull, however, the choice was limited to one good specimen each. The size of the acetabulae of the pelvis suggested the proper size of the femora, and these in turn provided a key to size of the tibiotarsus. The specimen of the latter element was found with a tarsometatarsus, evidently of the same individual; these two bones were used.

Of two available sterna, both were of a size that appeared to correlate with the pelvis. The coracoid size was gauged by fit into the coracoidal sulci of the sternum. Measurements of the coracoids used indicate medium size within the small group. The humeri selected were two of four elements, all much of a size. Except for medium size, there is no other means of correlating this element with the body skeleton.

Fortunately the single skull and single pelvis appear to represent birds of medium size, and therefore choice of medium-sized limb elements seemed logical.

Ribs, and only a few vertebrae were available. Rather than to model these parts, the bones of a California Murre (Uria aalge californica), of comparable size, were used. Body size of the Murre, as indicated by sternal breadth was previously shown to be similar to Mancalla (Miller and Howard, 1949:207). Furthermore the vertebrae of U. a. californica specimen LACM no. Bi 507 were found to correspond satisfactorily in size to the one cervical, one thoracic and first synsacral vertebra (attached to the pelvis found among the fossil elements. The lower mandible of the same specimen of Uria (no. Bi 507) was also used.

See over for list of specimens selected

List of Mancelle bones from San Diego used in mount:

Skull	2205			
Sternum	2063			
Pelvis	2182			
Coracoid	Left	2208 incomplete	Right	2243 complete
Scapula	"	no. ? 3/4 of bone	"	no. ? ½ of bone
Humerus	"	2303 complete	"	2442 complete
Ulna	"	2544	"	2543
Radius	"	2335	"	plaster cast
Carpometacarpus	"	2213	"	unnumbered
Femur	"	2097 complete	"	no. ? proximal ¾
Tibiotarsus	"	2210 distal end	"	2177 complete (found together)
Tarsometatarsus	"	2245	"	2177 complete

Lower mandible, ribs and vertebrae from modern skeleton of Uria aalge californica no. LACM Bi 507

Previously illustrated material

Pl 2 fig 1 humerus UCLA 2269 — M. milleri
" 2 " LACM 2066 — M. diegensis? Which 2066 is it?
" 3 " " 2096 — M. milleri
" 4 humerus UCLA 2281 — M. milleri
" 5 femur UCLA 2281
" 6+7 sterna UCLA 2220 + LACM 2063

Pl 3 " 1 coracoid UCLA 2270 — M. diegensis
" 2 " LACM 2087
" 3 " " 2067 — M. diegensis
" 4+5 mandible —
" 6 UCLA 2270 dist humerus — M. diegensis
Pl. 1 fig 7 also → " 7 ulnae LACM 2064 — M. diegensis
Pl 1 restored as drawn " 8 ulnae LACM 2082 — M. milleri
" 9 " LACM 2079 — M. milleri ♂ 3.3
" 10 " " 2101 — M. milleri
" 11 wing tarsus 2091 — ?
" 12 ulnae " no # — ?
" 13 tibia LACM 2107 — ?
" 14 prox humerus UCLA 2220 — M. diegensis
Pl. 4 fig 1 femur LACM 2097 — M. diegensis ♀ (49.0) fem 48.5 MT. 51.5
" 2 " UCLA 2220 — M. diegensis ♀ (left 51.2)
" 3 radius UCLA 2270 — M. [illegible] (26.9 (23.6) diegensis)
Pl drawn Pl 1 wing UC 55519 M. milleri " 4 scap LACM 2070 — M. milleri (11.3)
" 5 " " 2176 — M. diegensis (13.1)
" 6 " UCLA 2270 — M. milleri 10.4
" 7 " LACM 2049 — M. diegensis (12.2)
" 8 tibia " 2083 — M. milleri 14.5
" 9 " " 2125 — M. diegensis (92.7)
" 10 dist tibia " 2100 — M. milleri
" 11 " " UCLA 2270 (large) — M. diegensis ♂ 9.4
" 12 " " " (small) — M. milleri ♀ 6.4
" 13 wing " LACM 2108 — M. milleri ♂ 7.4
fig 14 wing " " 2134 → M. [illegible] (left 79?, negative 23.7
" 15 carpus " 2064 — M. milleri 23.6
" 16 " " 2268 —

Plate 5 fig. 1 comp. tibia 2177 — Pr. dreyeri? 80.8 mm Mt.
" 2 ulna " 2179 — M. milleri (23.9)
" 3 femur Lacm 2185 — M. milleri 44.8 (~~catalpha~~)
" 4 tarsus " 2178 — M. dreyeri (43.4)
" 5 " " 2177 — M. dreyeri (38.3)

Pl 6 fig 1 sternum 2180
" 2 pelvis 2182

Mt skeleton
Skull 2203
sternum 2063 (see Pl. 2 fig. 7) 38.7 mm br at 1st catalpha (#2180 on Pl 6 = sternum @ pubis)
pelvis 2182 (see Pl 6 fig. 2 31 mm broadest area
coracoid 2208 M. milleri 31.5 2243 M. milleri 41.4
scap ? no #'s ice
humerus 2303 M. milleri 62.7 2442 M. milleri? (not measd
ulna 2344 not measd 2543 ~~illegible~~ not measd
radius 2335 " " (Made in plaster side)
carpus 2213 not meas. Sternum not Id
femur 2097 ~~dreyeri~~ milleri? 50.4 (48.5)
tibia 2210 br 83 rubbly 2177 M. dreyeri 50.8, 38.3 (= tibia + calcaneum)
tarsus 2245 not meas. 2177 " "
(= Cedro) (= calcaneum + astragalus)

Postcranium of dreyeri:

To agree with Cedro (Natrohumerus & femur should have been 43.3 mm. (= 024 & tal calx)
" " " femur " " 73.6
" " " tibia " " 78 mm
" " " natro femur & tibia " "
" " " tibia " "
" " " tarsus & femur tarsus should be shorter 34.2
" " " or femur longer 53.6

Ratio tarsus & tibia in Lacm 2177 47.42 ↓ tarsus TO small in rel to
femur & tibia, in rel 60% femur & tarsus in rel 47% close

15333 femur & tibia 83.9 = 62.4%
5 " " 83.9 = 62.4%
12804 " & tarsus = 33.3
52.1 38.3
01
52.8

15333 tarsus & tibia should have been 37.7 to 38.3
ratio of 15333 tarsus & tibia 45.20
(femur 37.7 — 46.6%
38.3 —

unmonographed

28 Coracoid	30	16	8+1		1		
	11	4	7		11	2	19
10 scapula			1	fucula	1		
					11	12	144
90 humerus			+39+2		1		
	75	24				4	32
23 ulna	27	6	4+1				
					0	3	10
	5	5	1				
6 rad.					1	3	28
	12	8	8				
17 carp							
	22	9	12+3		11	5	30
10 fem							
					11	2	62
42 tib	35	20	17+1				
	13	8	7+2		1	4	29
16 tars.							
	230	100				42	398
			+				
3 cran	2?	1?	3 sheet			305	
	232	101				347	
6 rost					1		
3 mand.					1		
Pedal appliances							
39 vert.			13	total 31		398	
						338	
						60	
9 sternum	1	1	7+2			97	
						68	
			4+1			14	
pelvis							
6 sacrum					1		
	233	102					
with pel. fos.							
	278		310		16		
	145		1		278		
	42		132		294		
	465		13				
			145				
wing phal 11							
	138 Refer						
	278						
	16						
	432						
1 quadrat 1							
305							

Sept. 3, 1969
more added later

	M. diegense Left		M. diegense right	Cedros L	Cedros R	M. milleri Left		M. milleri right
31 Humeri								
complete	2		4		2	14	(10at mus.	8 (3Mus)
nearly "	1	TOTAL	1		TOT			
incomp.	4	26	2		11	3	includes 9 UCMP 1 UCLA +2 imnt	1
prox.	43	includes 3 UCMP 3 UCLA	32	4	4	11	76 (78)	14 (homex)
dist.	46		34	1		12		13 78
shaft	2		2					
	13 16		13	5	6	40		36
30 Tibiotarsi								
complete	2	TOTAL	4	1	TOT 5			
nearly "	1	19 30	3	1 prox		4	TOTAL	6
distal	5	includes 1 UCMP 1 UCLA	4+imt	3	not by L or R	1	35	1
	8		11			5	includes 4 UCLA 1 UCMP	10 35
								1 inc
						4 prox		3 prox
						14		21
8 Tarsometatarsi	not 2 imt included							
complete	2	TOTAL	1+imt	1	TOT 2	3	Total	3
incomp.	1	7 8	1	1	7 1	2x	3	5 (mus)
near comp.		includes 1 UCMP	1			2	includes 1 UCMP	dist 1 14
proximal	1		2			4 5		9
	4		34	4	3			
15 Coracoid								
complete	4	includes 2 UCMP	3			6	TOTAL 28	+2 imnt = 30
upper end			1			7	includes 2 UCMP	2
lower end	2	Total 15	3			5	3 UCLA	3
inc. both ends	2					18		10
	8		7					
4 Scapula	1 (UCLA)		3			7	Total 9 +2 imnt = 11 includes 1 UCMP 3 UCLA	2
	TOTAL 4						TOTAL 9	
4 Radius	TOTAL 4 large including 1 UCLA and 1 UCMP					TOTAL 4 small +1 imnt = 5 3 of which are ~~UCLA~~ UCMP		
6 Ulna								
complete	3 2	included 1 UCMP				15 17	includes 1 UCLA 2 UCMP	29
incomplete	2					11		
proximal	1					1		
	6 TOTAL					27 27	TOTAL	
12 Femora								
complete	1	TOTAL 12	1			2	3	2 +1 imnt
prox	2	includes 4 UCMP 1 UCLA	2			3+imnt		3
dist	3		1			6	TOTAL 23 includes 3 UCLA 1 UCMP 3 2DStat	2 25
shaft	2					11	3	9 10
	8		4					
8 Carpometacarp		TOTAL 8					TOTAL 12	
complete	1		3			1		4
prox	1		1			1	includes 1 UCMP 2 UCLA	
shafts						4		12
inc. prox.	1	includes 1 UCMP						
inc poor	1		1			2		
	3		5			8	4	239

104

237

Large — red = at home

Carpals LACM

L left prox 1 — 10.3/14.9 ht — 2660

1 mic prox

1 R prox — 10.3/14.9 — 2305

1 prox/pisiform complete — 2064 (35 mm)

mandibles

tips (2 large ? (1 with crack; 3 small ?

3 small artic ends

Complete 1 left — 3 right (including 1 UCMP

Small carpals LACM

Right 4 comps (1 which is UCMP) & 2 in UCLA

2 Left pisiform comp

① 2252 — 32.8 mm — 14.1 (M1 depth)

② 2450 — 32.5 ht — 12.8 dist M1

4 mic (runners, but strong) small

1 prox 2295 — 8.9 depth M1

UCLA

1 comp L, V5515 in mus — 31 mm — 9.2 M1 depth — 13.5 " ht

1 left

Femora (more in UCLA at mus.

red = at home

UCMP

Large L dist 46022 — Br 10.8

L prox 46025 — depth 7.8 small — Br prox 11.0 ngrowth

1 comp. UCLA

L dist (Large) 46021 — Br 9.9 ?

R 45891 — 5.0 prox ¾ Large

LACM

L Small

2227 depression prox ¾ — depth 8.2 — Br 4.0

1 left prox, 1 worn prox, 1 mic dist

2 left comps, 4 left dist (1 is UCLA)

L Large

1 Shaft + prox dist — Br sh 4.5

1 Shaft only — Br sh 4.5

2 dist LACM

1 prox "

R

1 right prox

1 prox mic

2 ch (1 omit as repeat spec.)

1 mic with worn prox

1 mic in 2 pcs (2162)

4 mic

2 right complete (one in 2 pcs in UCLA)

1 prox Right 2651 — depth 7.5 trochanter — Br prox 10.1

1 right dist

SUS small

3 comp + # some mic mt sh +

MANDIBLES ~~(upper)~~x
- 2 large rostrum +2 in mt
- ~~3~~ small ? rostra
- 3 artic. ends (small?) lower Mand

10

Crania
- 2 (at least 1 is large

2

Sternum 13
- 2 probably large (1 definitely)
- 5 small (+2 illus (1 in UCLA, 1 LACM in mt) Total 7

} 9 + 1 more elles = 10 + 3 frags = 13

Sacra and pelvis
- 4 sacra (sizes ? + 2 old list = 6
- 1 UCLA illus.
- 1 LACM illus & in mt.

} + 3 frags = 5

11

10
2
13
11
36

large

Humerus

	L	R
Complete	II	IIII
inc (prox) 3/4	III	III
prox end	III	II
dist "	IIII	IIII
inc both ends broken		II
	16	15

small

	L	R
	IIII II	UCMP-9 UCLA-7 III III
	25 II IIII I	5 III IIII 14
	12 IIII II	III III 13
	3 III	1 1
	40	36

Cracoids

Comp.	4	3
lower	2	3
upper		1
inc both end	2	
	8	7

5+1	6
III+2	5
	7
	18

	5
	3
	2
	10

Carpometacarp

large

	L	R
Complete	1	3 (1 is UCMP)
inc. prox.		1
prox	1	1
prox inc	1	
	3	5

small

	L	R
	5 (2 UCMP 2 UCLA)	1 (UCMP)
	2	
shafts	4	1
shafts Badly preserved		4
	8	4

L + R 4 (1 UCMP 2 UCLA

Femora

large

L

complete — 1 UCLA

prox — 1 UCMP, 1 LACM

dist — 1 UCMP, 2 LACM

shaft — 2 LACM

includes ½ UCMP, 1 UCLA

9 Total 13

R

1 Type UCMP

1 UCMP, 1 LACM

~~1 UCMP, 1 LACM~~ (UCMP, 1 LACM)

small

L

2. (+3 comp ROLS)

R

2 ~~1 UCLA~~ (one is LACM, one is UCLA)

1 comp in spec is also UCLA

1 in 2 pcs LACM

3 → 3

1 ino dist

5 dist (includes UCMP, 1 LACM, 2 UCLA)

2

10 + 3 (3 SD State) + 9 TOTAL 23

includes ~~4 UCLA~~ 3 UCLA, 3 SD State, 1 UCMP

Carpometacarpi

Paratype coracoid 2627 39.0 2170 ~~Holotype~~ 49,4 ← 140% shaft mag ← 40,0

" tarso 2682 31,1 mm 2270 shaft 39,9 ← 15% shaft ← 34,0

" humer 2813

type femur 2185

~~[illegible]~~

Of the measd specimens ~~[illegible]~~ recorded in 1949, both coracoids (2067+2067) ~~are within the range of~~ 2 humeri (2098 + UCLA 2220 ~~[illegible]~~) 1 ulna (2064), 2 carpi (2060 comp + 2068 proximal) 1 femur (2220) in addition to the type, 1 tibia (2294, 2125, UCLA 2270, 2177) 1 tarsus 2177) are within the range of M. diegensis.

		diegensis mean		mielani mean	
Mesorhinus	85,8	76,5	89,3	62,7	73,2
		96,2	104	74,9	86,5
tibia	86,4	39,9	80,5	34,0	68,4
tarso	49,5	29,4	46	25,5	39,7
ulna	64,1	55,2	113	42,9	98,5 70
femur	48,6	49,4	133	40,0	108 70
Coracoid	37,1	~~51,7~~	104	(38,0	100 70 -
Br Stem	~~38,6~~	44		~~39~~	~~41~~

at 1 costas 2 proxs

and tarsometatarsi there are intermediate specimens that, on the basis of linear dimension alone might belong to either group. The shape of the furcular facet of the questionable coracoid places this specimen with M. diegense. The less depressed, more flaring shaft of both questionable tarsometatarsi places them with M. diegense, and as the smaller of the two intermediate-sized specimens of tibiotarsi was found associated with one of these tarsometatarsi (see Miller and Howard, 1949:226), both of the tibiotarsi are placed with M. diegense. Although there are no qualitative characters to distinguish the radius, placing the questionable bone with M. diegense is appropriate in view of the size range of the ulna.

As a further check on the correctness of these assignments, comparison with the Cedros Island specimens has been helpful. The island sample is undoubtedly of a single species, and, although differing in some proportions, is close in size to M. diegense. Table III provides a comparison of the size range for M. diegense with that of the Cedros Island form (here described) as well as the smaller San Diegospecies.

Humboldt County, Calif. humerus of Mancalla

from Mr. Kohl

Length	80.9
Br. prox	19.5
Br. dist	7.0
Length to dist. end of deltoid	55.0
Gr. depth Sh.	11.5
Br. middle sh.	4.5
Ht ectepicond. process above dist end	17.3

Mr. Kohl's other material, supposedly from same site as Mancalla Bon.

Dist. end humerus - Greenwinged Teal

Comp. R carpometa. - Surf Scoter (and scap. probably the same sp.)

R coracoid - Golden eye Duck (?)

Pedal Phalanx - Common Loon

Humeral frag. - Duck (Bufflehead?, Harlequin?)

Dist. end tibiotarsus - Grebe (Holboell's?)

2 large cervicals - Chendytes (?)

Hope Miller osteology coll.

UCSB material

Marcella = 51

Humeri complete; 2218, 2281, 2269 } m. milleri
proximal 2220(2), 2281, 2345 }
distal 2345, 2269, 1367 (frag.) m. diegensis
shafts 2281, 2294(2) - (sp.?)
no # dist (2220?)

(a 3rd mid 2220 = diegensis Br. 18.0 sp?)

15

3 Coracoids (incomplete) 2345, 2270 (m. milleri based on size) not m. diegensis?

3 Scapulae 2270 (10.9), 2345 (10.7) (a) m milleri
2345 (14.4) (b) m. diegensis

1 Ulna 2345 (26.4) m. milleri

1 Radius 2270 (26.9) m. milleri

2 Carpometacarpi 2281 (31.8), 2345 (31.0) - m. milleri

5 femora 2270 (dist 9.2 (2 per R)), 2270 (dist. left) (9.4), 2345 complete - m. milleri
2220 - m. diegensis
2218. shaft. sp?

8 Tibiotarsi 2294 (91.2, dist 8.7 R) m. diegensis
2270 (dist R 9.3 " "
2345 left 7.3 dist 7.4, m. milleri
dist. 2270 (7.0), 2294 (7.0) - m. milleri
shafts 2281, 2270 - m. milleri
dist 2294 broken - m. diegensis?

4 Tarsometatarsi 2345 inc R - m. milleri
frags 2220 shaft - m. diegensis?
2220 dist L " " ?
no. # inc L " " ?

1 1 Pelvic frag. 2281 (prb. 33.4 (across acetabulae) sp?

4 4 Sacral frags 2270, 2281, 2270 (mid), 2345 (ant) sp?

2 Vertebrae 2281, 2220 - sp. frag.

1 Sternum - manubrium 2220 - m. milleri?

4 Furcula 2345 (lateral tip) sp.

Cormorant vertebra no. # P. kennelli?

Brachyramphus gloriosus shaft & humerus 2294

Prox tarsus 2270 - indet?

" carpometa no # " (P. kanakoffi?)

furcula 2294 (2) "

dist end tarsus 2294 indet? (grebe?)

pedal phalanx 2345 "

dist end tibia 2294 (grebe?)

frags unidentified 2294 (4 frags.)
2270 (2 ")
2218 (1 ")
no. # (1 pedal phalanx
1 " " 1 " "

4 frags Bird?

P (fish no.) 2345 (in jar with 1 frag mille

Cotyles Brachyramphus gloriosus dist end humerus 2218
complete ulna 2281

1 Laid tibia (dist)
2346c 474 (V499)
Barston
in vial

145
3
435

Univ. Calif. Museum of Paleontology = 48

13 Humerus 45842 ✓ ✓45849 45846 ✓
45843 ✓ ✓45850 (2) 45847 (2) ✓✓
✓✓(2) 45856 (2) ✓46029 ✓ ✓5520
✓ 45858 ✓45857 ✓

8 Coracoid 45843 ✓ millei 46017 ✓ (~~45846 = 45846?~~)
45863 ✓ 45864 ✓ (~~46027 = 46026?~~)
(2) 45844 (2) 46028 ✓ 46027 (immature) ✓

2 Scapula 45882 millei
45860 ✓ diegensis

5 Ulna ✓45853 ✓ 4 Radius ✓46016 ✓
✓45859 ✓ ✓46030 ✓
✓45854 ✓ complete 45842 ✓
✓45842 ✓ ✓5519 ✓
✓5519 ✓

4 Carpometacarpus
amplum
millei ✓45842 ✓ ✓5518 ✓
✓45861 ✓ diegensis
millei ✓45862 ✓

3 Femur ✓46022 ✓ ✓45888
✓45851 ✓ ✓45891 ✓
✓46025 ✓

3 Tibiotarsus 46015 ✓ 42865 ✓
45890 ✓

4 Tarsometatarsus
✓45852 ✓ ✓45855
✓45885 ✓46024

LACM (cat. 1951 LHM 15)

90
35
28
15
28
10
86
21
13
50
13

389 LACM
48 UC
51 Total LHM
3 dds

491

Univ. Calif. Berkeley – Macoma from S. Diego Pliocene

Sept. 1960

Californiacarpus mmr

	depth prox end	length prox M1	br track	length from prox end distal of M1	ap length	depth at base track thru M1
comparisons 45842	9.2	13.4	—	16.2	30.9	8.4
45861	10.9	15.4	4.8	19.1	35.8	
45862	9.6	17.3	3.2	17.4	33.2	

	length	Radius depth
46016	30.6	6.4
46030, comparisons 45842	25.2??	5.3 eroded
	24.2	4.5+

	ap length tibec.	Ulna length b.artic. w/out ink cond.	Depth sh	diag b. dist	br prox	br dist	Depth prox	
45853	—	25.3	5.7	7.2	6.1	4.3	—	small?
45859	27.9	28.3	5.5	7.0	6.1	4.4	9.8	
45854	2—	23.2?	4.7	5.8	—	4.1	—	
45842	26.2	26.2	—	—	—	—	7.8	

Univ. Calif. Berkeley - Mancalla from S.D. Pliocene Sept. 1960

Coracoid

	tip to tip length	Depth facet	length top process ?	length from cupoid facet to caudal shaft of sternal facet	Depth neck	br. fore facet	length to mid sternal end
45843	41.9	5.8	12.3	28.8	5.1	5.9	40.2
45863	51.3	6.5	13.7	—	6.2	8.8	49.0 ab.
45844	40.8	5.7	11.0	29.3	5.1	6.0	40.5
46017	—	5.9	—	—	—	—	—
45864	—	—	—	—	—	5.7	6.9
46028	44.4	5.9	12.8	32.9	5.0	7.1	44.6
45844 juv							44.9

Scapula

	br. prox.	least br. at facet	br. base through tubercle
45882	11.5	4.8	5.8
45860	14.4	6.0	6.2

Univ. Calif. Berkeley - Mancalla from San Diego Pliocene Sept 1960

Femur

	length gr	int length	br dist condyle	br prox	br sh	gr depth ext. condyle	caliper plot on ant. side depth dist end	depth tech. anter
46022	—	—	11.1			10.8	10.3	
broken ends 45858	—	44.3	—	8.5 g	4.3	—	—	6.2 g
46025	—	—	—	11.4	—	—	—	8.4
45888	—	—	—	8.3 g	4.2 ?	—	—	—
45891	—	—	—	—	5.1	—	—	7.6

Femur

Tibiotarsus

	length fragics.	br dist	br shaft	depth shaft	depth dist
broken ends 46015	98.8	10.7	7.1	4.3	9.9
broken ends 45890	—	8.7 g	—	—	7.7

Tarsometatarsus

	gr length	prox br	dist br	br sh	(partial) length bet. hor. antiformin
45852	—	10.7	—	5.3	24.8
45885				5.2	
45855	—	—	—	4.8	—
44024	—	8.3	—	—	—

Univ. Calif. Berkeley – Mancalla from S. Diego Pliocene

Sept. 1960

Humerus – mm

	Dupl. 1960 or comparable with humerus length to dist cond.	Gr prox	br dist	length to end of deltoid	length to tip distal tuberosity	Depth prox deltoid	ht epi condyl	
S45842	61.0	14.6	—	—	—	—		
S45845	62.8	15.2	5.7	41.6	63.2	8.7		
L45856?	—	—	6.7	—	—	11.1	15.5	?
L45856	—	—	7.3	—	—	—	17.8	?
L45858	—	18.3 broken	—	—	—	—		large
S45849	—	14.7	—	44.9 ap	—	8.1		small
S45850	—	15.3	—	—	—	—		small
S46029	—	16.1	—	—	—	—		small?
L45857	—	—	6.9	—	—	—	17.0	
S45854	—	—	6.0	—	—	9.3	13.8	small
S45847	—	—	6.2	—	—	9.3	14.7	small
S45847	—	—	5.3	—	—	8.2	12.6	small

Measured Maucalla – all areas

Scapula 14 LACM
18 2 UC
3 LHM

Coracoid 21 LACM + 12 poor
25+20 4 UC + 5 poor
3 unmeas LHM

Humerus 55 LACM
67 7 UC
5 LHM

Ulna 31 LACM
36 5 UC

Radius 6 LACM
11 4 UC
1 LHM

Carpus 12 LACM + 6 poor
18 4 UC
2 LHM

Femur 12 LACM + 8 poor
31 4 LHM
7 UC (including tyke)
3 SDS

Tibia 21 LACM + 23 poor
24+23 2 LHM
1 UC

Tarsus 16 LACM + 6 poor
20+7 3 UC + 1 "
1 LHM

stereum LACM 7
7

18
25
20
47
36
11
18
31
24
23
27
300
~~74~~
374

Pelvis, vert, fem, fibula
9 LHM
22 unassigned
31 LAM
12 stereum
74

Mounted skeleton of Mancalla from San Diego Pliocene

The LACM had 224 bones of Mancalla from San Diego when selection of specimens for a mount was begun

Although there are many duplicate specimens of certain elements, the great variation in size allowed less freedom of choice than might be expected in selection for the mount. The few outstandingly large specimens in the collection were set aside (as possibly representing a separate species) and the choice for the mounted skeleton was made from the more abundant group of small specimens. In the pelvis and skull, however, the choice was limited to one good specimen each. The size of the acetabulae of the pelvis suggested the proper size of the femora, and these in turn provided a key to size of the tibiotarsus. The specimen of the latter element was found with a tarsometatarsus, evidently of the same individual; these two bones were used.

Of two available sterna, both were of a size that appeared to correlate with the pelvis. The coracoid size was gauged by fit into the coracoidal sulci of the sternum. Measurements of the coracoids used indicate medium size within the small group. The humeri selected were two of four elements, all much of a size. Except for medium size, there is no other means of correlating this element with the body skeleton.

Fortunately the single skull and single pelvis appear to represent birds of medium size, and therefore choice of medium-sized limb elements seemed logical.

No ribs, and only a few vertebrae were available. Rather than to model these parts, the bones of a California Murre (Uria aalge californica), of comparable size, were used. Body size of the Murre, as indicated by sternal breadth was previously shown to be similar to Mancalla (Miller and Howard, 1949:207). Furthermore the vertebrae of U. a. californica specimen LACM no. Bi 507 were found to correspond satisfactorily in size to the one cervical, one thoracic and first synsacral vertebra (attached to the pelvis found among the fossil elements. The lower mandible of the same specimen of Uria (no. Bi 507) was also used.

See ~~over~~ next page for list of specimens selected

List of Mancalla bones from San Diego used in mount:

Skull	2205	br. 27.1 ... complete skull ... 22.3 ... 16.7 br at same point			
Sternum	2063	br. 34.2 across ventral labial prominences;			
Pelvis	2182	length sacrum 68			
Coracoid	Left	2208 incomplete	Right	2243 complete	length 41.7
Scapula	"	no. ? 3/4 of bone	"	no. ? ½ of bone	
Humerus	"	2303 complete S (mean)	"	2442 complete	
Ulna	"	2544	"	2543	
Radius	"	2335	"	plaster cast	
Carpometacarpus	"	2213	"	unnumbered	
Femur	"	2097 complete max S	"	no. ? proximal ¾	
Tibiotarsus	"	2210 distal end	"	2177 complete	found together
Tarsometatarsus	"	2245	"	2177 complete	found together

Lower mandible, ribs and vertebrae from modern skeleton of Uria aalge californica no. LACM Bi 507

Copied on next page

S = small = M. melleti ?
L = large = M. diegensis ?

Bones in Mancalla Mount

SKULL (cranium and rostrum with small connection) 2205
S — Breadth of cranium 27.1 mm.
Length from supraoccipital to tip of rostrum 101 mm.
Length of rostrum from ant. edge of nares to tip, 22.3 mm.
Breadth of rostrum at ant. edge of nares, 6.7 mm

STERNUM 2063 -- Breadth across ventral labial prominences 34.2 mm.
S — Breadth across either 1st or 2nd costal process, 37.8
Breadth between 1st and 2nd costal processes, 35.9 mm
Breadth back of 2nd costal process, 35.5 mm.

PELVIS 2182 -- Length of sacrum, 68 mm.
S — Breadth across antitrochanters, 30.6 mm

CORACOIDS -- Left (incomplete 2208
S+ — Length 42.0 (rebuilt)

Right complete 2243
Length 41.7 mm. above M

SCAPULAE — Left ¾ unnumbered?
S (aver) — Breadth articulation 11.0 M

Right ½ unnumbered?
Breadth articulation, 11.0mm

HUMERI — Left complete 2303
S (aver) — Length 62.7 (or 63.8) M

Right complete 2442
Length 62.7

ULNAE — Left 2544 complete
L- — Length 29.0 (meas on mt.

Right 2543 complete
Length 28.6 meas. on mt.

RADII — Left 2335 complete
S+ — Length 25.5 meas. on mt. slightly over M

Right -- plaster

CARPOMETACARPI — Left incomplete no #
L- — Length 35.4 meas. on mt.
Depth prox. thru M1 9.0
Length of M1, 13.5 mm.

Right 2213 complete
Length 35.1 mm
Depth thru M1, 9.9 mm.
Length of M1, 14.3

WING PHALANGES — Left 2558 (or 2158 or 56)
Length, 15.6 mm. inc.

Right unnumbered
Length 12.5 mm. complete

FEMORA — Left 2097 complete
S+ — Length 50.4 (greatest) near max
Proximal breadth, 9.2 mm.
Distal breadth, 9.3 mm.

Right unnumbered proximal ed

TIBIOTARSI — Left 2210 distal end
S+ (or L-)

near max Right 2177 complete
Length 80.8 mm
FOUND IN PLACE WITH TARSUS

TARSOMETATARSI — Left 2245 incomplete
(S major L minor)

Right 2177 complete
Length, 38.3 mm.
minor L Breadth distal trochleae 8.1
Breadth proximal end 9.8
Breadth trochleae 2&3, 6.2 mm.
Breadth shaft (min.) 4.6 mm.

Lower mandible, ribs, vertebrae, fibulae from modern skeleton of Uria aalge californica no. LACM Bi 507. Furcula is plaster except for articular end on right side (unnumbered)

Criteria of heterogeneity per Simpson, Roe & Lewontin see Tedin p. 25
"Quantitative Zoology" 1960, Harcourt Brace & Co. N.Y., Burlingame

p. 102
"If a distribution of a sample is definitely bimodal & can be shown to combine 2 distributions with different parameters, then the sample & the populations are surely heterogeneous." (tests for this, see Chap. 10)
(see p. 199 for adequacy of a sample determined from theory of sampling limits)

Definition of "parameter" p. 97
"a parameter is a constant which describes some quantitative aspect of a population, for example the population mean, median, mode, range & variance are parameters whose values vary from popul. to popul. but which are fixed for a given population & which describe central tendencies & dispersion peculiar to each assemblage of animals. Sample characteristics, on the other hand, like sample means & sample variances, will vary from sample to sample even when the samples are drawn every time from the same population."
parameters expressed in greek letters
samples in latin equivalents

See p. 201 et do heterogeneity of samples
especially p. 205 "There are other tests of heterogeneity that never amount to proof but may be suggestive [that is if populations overlap so that bi modality is not clear] "A distribution with an unduly large V (coef var.) much larger than for the same variate in related samples, is likely to be heterogeneous & so is one that is strongly platykurtic. Some homogeneous distributions have high V's & some platykurtic curves do not mean as conclusive evidence of heterogeneity

over

Kurtosis is merely of being more pointed or more flat than normal curve with same parameters
$\Sigma d^4 / N s^4 - 3$ $(s^4 = (\Sigma d^2 / N-1)^2$ $d = x - \bar{x}$

p. 207 In general in dealing with linear dimensions of functional unreduced anatomical elements, when marked changes due to growth are not involved, V may be assumed probably not to exceed 10 or it is almost never so great as 15, usually it is from 3 to 7 provided the sample is reasonably homogeneous. --- V's for functional anatomical parts are usually lower in birds than in mammals.

p. 210 It is a commonly used criterion in some taxonomic work that a diff. of 15% in a linear dimension is in itself of probable specific value. This is a traditional rule of Thumb that has no scientific basis. Clearly it implies some criteria as to variability, the most useful & exact measure of which is V. Now a diff. of 15% implies a coefficient of 1,15 & the corresponding minimum likely value of V is bet. 3 & 4. This is a usual value even for a pure sample of a local race & the conclusion is that the "15 per cent rule" will inevitably separate some specimens of a single species.

p211 In general, if no other criteria or clues are available, it is improper to assume that a difference in a linear dimension may characterize diff. tax. groups unless it implies a minimum V of at least 10, since V's as high as 10 or even higher are known to occur in such character of local races. Therefore if a percentage rule of Thumb is to be used at all in comparing isolated specimens, a diff of 50% is necessary to indicate sufficient likelihood of real tax. distinction

Standard deviation - hand method (Simpson & Quast 2nd revised. p, 8 & 6)

M = sum of frequency of number ($\Sigma f X$) (or sum of all numbers) divided by the number of specimens (N)

$$\text{Standard deviation}^2 = \frac{\Sigma f X^2 - \frac{(\Sigma f X)^2}{N}}{N-1}$$

$s = \sqrt{s^2}$

s = ~~standard dev. of sample of population~~ sample estimate of standard dev. of a population

σ = population standard dev. estimated by s

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Coef. of variation (V) is arrived at by formula (100 × standard dev. divided by Mean)

$$V = \frac{100s}{M}$$

41192
41192
82384
370728
41193
41192
165168
700780.84 | 24296895

7 | 14
30
28
20
14
67
63
48
42
60
56
48
42
64
63
34

151
56 | 8500
56
290
280
100

9.91
659 | 6531.0
5931
6040
5931
1090

6.57
7657 | 49980.1
45942
4038.0
3828.5
20950
628

Tibiotarsus
Br. dist. end

Mancalla
>D

Tibiotarsus
length to top fib. crest

July 13, 1961
length to dist. end fib. cr.

	Br. dist. end		length to top fib. crest		length to dist. end fib. cr.	
68	II	4	60	1	47	
69	II		61		48	3
70			62	1	49	2
71	II	2	63		50	
72			64	2	51	3
73	IIII	4	65		52	
74	II	3	66	1	53	0
75	I		67		54	
76	III	3	68	0	55	1
77			69		56	
78	I	2	70	0	57	1
79	I		71		58	
80		0	72	2	59	3
81			73		60	
82		3	74	0	61	3
83	III		75		62	
84	I	2	76	0		
85	I		77			
86	I	3	78	4		
87	II		79			
88		1	80	1		
89	I		81			
90	I	3	82	0		
91	II		83			
92	I	1	84	1		
93						
94	II	2				
95						
96	II	3				
97	I					
98	I	1				
99						
100	II	2				
101						
102		0				
103						
104	I	1				
105						
106	I	1				
107						
108		0				
109						
110		1				
111						

71	2	9	
72			
73	2		
74			
75	2		
76			
77	1		
78			
79	1		
80			
81	1		
82			
83	0		
84			
85	0		
86			
87	0		
88			
89	0		
90			
91	2	5	
92			
93	2		
94			
95	0		
96			
97	1		
98			

hum. mor Marcella S. D.

	14.2	14.2	14.0-4 — 2
-.1	14.2	14.3	
	14.3		
.3	14.6		6
	14.6	14.5-9	
	14.6		
.1	14.6		
	14.7		
.1	14.8		
	14.8		
.2	15.0		
	15.0		
	15.0	15.0-4	14
.1	15.0		
	15.1		
	15.1		
.1	15.1		
	15.2		
.3	15.2		
	15.3		
.1	15.4		
.1	15.5		
	15.5		
	15.5		
.1	15.6	15.5-9	12
	15.6		
	15.6		
.1	15.7		
	15.7		
	15.7		
	15.7		
.1	15.8		
	15.8		
.3	16.1	16.0-4	6
.1	16.2		
.1	16.3		
	16.		
.1	16.4		0
.1	16.5-16.9		1
.5	17.0-4		2
.5	17.5-9		
.7	18.2		5
	18.2	18.0-4	
.1	18.2		
.1	18.3		
.1	18.4		
.1	18.5		4
	18.5	18.5-9	
.1	18.6		
.1	18.7		
.2	18.9	19.0-4	1
.4	19.3		0
.7	20.0	20-4	1
	20.3		

56-57	1
58-59	2
60-61	5
62-63	11
64-65	2
66-67	3
68-69 —	0 —
70-71	1
72-73	2
44-75	1
76-77	1
78-79	1
80-81	1
82-83	0
84-85	1

56 57 58 3
59 60 61 5
62 63 64

67
68
69

56 —	1	77-78-2	
		79-80 1	
57-58	2	81-82	0
59-60	0	83 84	0
61-62	9	85	1
63,64	7		
65,66	5		
67,68	0		
69-70,	0		
71-72	2		
73-74	2		
75-76	1		

Mancalla diegense Miller

The humerus is the best represented element at San Diego. Of 105 humeri now available from the area, 33 can now be measured for length and 42 for breadth of proximal end. In length, the maximum bone is 151 per cent of the minimum, with a coefficient of variability (V) for the series, of 10.2. In a series of 300 humeri of the flightless auk, Pinguinis impennis, recorded by Lucas (1888:492), the maximum bone is only 114 per cent of the minimum in greatest length and the series has a V of 3.0. Although none of the other skeletal elements of Mancalla is as abundant as the humerus, each shows a wide range in measurement of length and a V greater than 7 (Table 1). Simpson et al (1960: 207) state that, unless changes due to growth are involved, a homogeneous sample for a linear dimension usually has a V of 3 to 7 in mammals; birds are said to tend to have lower V's than mammals. That the range in size in Mancalla cannot be attributed to age is evidenced by the state of ossification of the bones measured. It is now definitely indicated, therefore, that more than one species of Mancalla is represented in the San Diego material. In the humeri the distributional curve for greatest length is distinctly bimodal, with 23 specimens less than 67 mm. long and 10 of 71 mm. or greater. The same bimodality is shown in the proximal breadth, the smaller group measuring from 14.2 to 15.6 mm., the larger bones with a breadth of 18.2 - 20.3 mm. In the 15 femora in which a linear measurement can be taken or can be reasonably estimated, 10 measure 51 mm. or less, and five are over 54 mm. Distal breadths for the same series range from 8.5-9.3 for the short bones and 10.3-11.3 for the long ones. The type specimen of M. diegense, a femur (UCMP no. 33409) falls among the bones of maximum size. It is obvious, therefore, that the small, most abundant species found at San Diego can no longer hold the title of Mancalla diegense. This name must now be applied to the larger form, which was previously of lesser abundance,

Mancalla californiensis and M. diegense

It has been previously noted (Miller and Howard, 1949:225, and Miller, 1956:618) that two species of Mancalla were probably present in the Pliocene of San Diego. The larger of these, and the specimens from Corona del Mar (also of comparatively large size) were presumed to represent Mancalla californiensis. The smaller, more abundant species has been known as Mancalla diegense, with the type a femur from San Diego, originally described as Pliolunda diegense (see Miller and Howard, loc. cit.). The assignment of the Corona del Mar bird to M. californiensis seems justifiable now that portions of humeri can actually be compared with the type from Los Angeles. The San Diego humeri, however, differ in certain respects, and the carpometacarpi and coracoids are even more markedly distinguishable from these elements in the Corona del Mar collections. The larger specimens from San Diego can no longer, therefore, be identified as M. californiensis.

The size range in the San Diego material, previously noted, has become even more marked with the additonal material now at hand. The femora now at hand include at least a dozen that are 10-30% smaller than the type of M. diegense, and only a possible three that equal or slightly exceed it. It is now clear that the type of M. diegense belongs to the larger of the two San Diego species, not to the dominant small form.

Table 1 is offered by way of an amended diagnosis of the species M. californiensis and M. diegense. In most of the qualitative characters set forth, the smaller species from San Diego agrees with M. diegense. Distinctions between the two San Diego species are largely a matter of size.

Tarsometatarsi

Of the 27 ~~adult~~ specimens of this element only 8 ~~affords~~ ~~are complete~~ afford a reliable measure of length. Others can be meas. for breadths or dists, and but seven can be measured; ~~four additional essentially complete tarsometatarsi~~ from San Diego have been added to the two already ~~recorded~~. Extinct ~~by the one~~ specimen. One nearly complete specimen was found in the Corona del Mar deposit, a meas. of length ext. with condyles as for ~~except for the one large S.D.~~ taken on this specimen, but not p. length ~~specimen~~

There is not the marked division into two size groups in this element. ~~With the exception of no. 2178 from San Diego, those from Corona del~~ Mar, all other specimens appear to range in a normal size group. Even from largest to smallest of all specimens the range is less than 10mm. Either, the tarsometatarsus does not follow the same proportions as the other elements, or the extremes of size are not yet available. The fact that The first pair of tarsi found at Corona del Mar appear to be ~~about~~ small, whereas all other Manculla bones from that locality are obviously of large species, suggests the former alternative — namely that the tarsus of the large species is relatively shorter than in the small species so that their ranges overlap.

38.3
31.1
7.2

At least 4 small, 3 large (counting 2 shafts) — Corona del Mar suggests less marked depression of centre of shaft & lower ext. rim of shaft. The one complete C&M lacks border to shaft internally rimmed, below head which is present in SD large & small. Other than size, I can't point to any dif. in SD. specimens

But may be due to immaturity

2178	43.7
2250	
C.DM	40.5
2034 ext	38.8
2177	38.3
2499	37.1
2327	36.0
2488	34.8
2489 ext.	34

M. milleri

43.6
40.5
2) 84.1
42.0

241
3r3
3)12.24 (4.08

(41.9 ext. fem.)

Tarsi - (1 complete, 1 lacking distal, 2 dist. ends) or, lgst 43.6 - (possible 38.3) or 40.5 (U.C.)
designation
2178 UC 4585-2
2224 & 2499

M. milleri 6 complete 2499
+1 nearly " 2327
6457 2488
2831 ap.
2548
2682

plus 1 dist, 2 prox. & 3 frag. sh.
6457 2232 L? 2857.
2490 pg. 2469.
2224.

34.7 av.
over 3) 243.3
21
33
24
93

243.3
38.3
8) 281.6 (35.2 av.
24
41
40
1.6

38.3?, or 37.0 max
31.1 min. (30.0 to ext. cond.)

over. max is 119% of av. min. if #2177 is placed as small sp.
" " " 117% " " " " # " " " large sp.

absolute max is 139 - 140% of absolute min.
(41.9-30) (43.6-31.1)

2177 may be male adult small or ♀ adult large.
[note that tibiotarsus with it has budgi]

Possible distinction bet. large & small S.D. tarsi;
in small ones shaft seems more columnar whereas
in large it is ~~more~~ flares more markedly from narrowest
point which is ~~below~~ distad to the center.

TABLE I

Comparison of Mancalla bones from Corona del Mar and San Diego

Element	Corona del Mar	San Diego
Coracoid carpus		
Anterior border of triosseal canal	Posterior to tip of furcular facet	On line with tip of furcular facet and forming anterior border of coracoid
Head	Broad and smoothly rounded above	Upper surface narrowed ~~anteriorly~~ and ~~poster-~~ to central ridge.
Tip of furcular facet	Blunt, lacking up-turned point	With up-turned point
Ulna		
Intermuscular line from below cotylae	Descends diagonally in straight line to internal edge of shaft, 4.3mm above distal articulation; juts back mediad to end in longitudinal ridge 3mm. long at internal edge of palmar surface of shaft above distal end	Curves as it descends to internal edge of shaft; return from edge negligible (curves in slightly)
Olecranon	Blunt with very shallow depression between it and cotylae	Blunt with deeper depression between it and cotylae
Ridge from olecranon to cotylae	Close to intercotylar ridge	Well internal to intercotylar ridge
Palmar side of shaft above distal end	Flat, and bordered by well-marked intermuscular lines	Slightly rounded and slanting off from internal to external side
Carpometacarpus		
Length ~~(Extensor process)~~ process	41.3 mm (1 complete)	37.1 mm. (maximum of six specimens)
Length/Metacarpal I	16.6-17.8 mm. (3 specimens); 145-159% of internal depth of proximal end through process	15.1-15.4 mm (6 specimens); 137 - 142 % of proximal depth
Internal trochlear crest	Not clearly demarcated from Metacarpal III	Clear indentation separating base of crest from M III.
Tarsometatarsus		
Groove proximal to distal foramen on anterior face of shaft	Faint depression immediately proximal to distal foramen, only, above this, shaft level or faintly convex	Marked groove extends proximally from distal foramen along external part of shaft.
External border of shaft anteriorly	Indistinctly raised	Distinctly raised for full length of shaft

M. milleri assigned

Ulnae — 45853 (25.1 ✓
2497 ① 26.2 ✓
2492 ② 25.2 ✓
6426 (26.3) ✓
25558 (24.5?) ✓
2179 (25.3) —
2484 (25.7) ✓
25552 (24.7) ✓
2082 (25.2 =
① 2439 (27.0) ✓
2079 (24.1 =
② 2342 (23.6) ✓

2435 r wan (24+ ap)
45854 " (23.7 ap)
25556 pmx
[2345? LHM? from ms 1969]

Coracoids L 45543 ✓ ← from ms 1969 - 2298 NW, 2243, 2627 pmx ptly ✓
R 2229 ✓
L 25559 ✓
L 2276 ✓
R 2338 ✓
R 2498 ✓
L 25557 ✓
L 46028 (? ap) ✓

Tarsometatarsi
R 25548 (32.5) ✓
L 2327 36.0 ✓
pmx ptly L 26822 (31.1)
R 64554 (33.7) ✓
R 2488 34.5 ✓

L 28318 (34?a-) nw
L 46026 pmx
L 2232 (pmx
R 24555 dist 3/4

Femora ucsa 2345 (31.2) (9.1) ✓
lacm 25508 (46.6) — ✓
" 2185 (47.2 (8.4) Tyn miller
" 2848 (44.9) (8.6 ✓
ucla 22700 2 pmx (48.2 est) lb dist 9.3
2240 —— (" 8.9)
25507 —— (8.5 pmx lb)
= 2244?-2249 —— (" 8.6)
SQS 139 46.8 ✓
" 024 46.8? ✓
" 2537 48.9 ✓
2097 mtj (50.4) dist 9.3 dist ✓

Carpometacarpus
Rucla 2281 (31.7) ✓
R " 2345 (30.9) ✓
Rucmp 45862 (33.1) ✓
Rlawn 2068 29.65 ✓

Assigned Sex (M. dufaurei)

Coracoid
- R: 2097 female, 2310 ✓, 2290 ✓
- L: 45863 ✓, 2422 ✓, 2849 ✓
- and 2498, 2067, 2087

Humerus
- 2670 — R 7731
- L: 2304 — L 2207; 6182 — L 2381 prox; 2685 ✓; H
- R 2482

Ulna
- R: 2064 (32.0) (1) — R 2248 prox ¾; 2323 (28.7) — R 2500 dist ¾
- L: no # (30.2) — L 2885(?) very worn ? (28.4 ?); 45859 (28.6) — R 2257 ¾ ?
- 2287 (28.+) broken

Tarsometatarsus
- ✓ R 43852 (40+ mm)
- ✓ L 2178 43.5
- ✓ R 2499 37.0
- ~~R 2177 est 38.3~~ ✓
- ~~R 2485~~ ✓ R 2224 dist ¾

Sexing world (5) 2 (L) 38.1 +40 other inc

Femora
- UCLA 2220 (54.3) R dist 10.15
- type UMMP 33409 (56.3) " 11.0
- Casma
- ?, ~~2672 est 54.0~~ ~~10.2 est~~
- ✓ 2078 est 54.7 " 10.3
- ✓ 2507 ~~est 57.0~~ 10.54
- ✓ 2668
- ✓ 2681 (10.7 prox b)

Carpometacarpus
- ✓ L 2542 — 35.5
- — R 43861 — 33.3
- — R 2541 — 37.1
- — R 2060/2545 — 35.8
- when 2060 — 39.0

Cetrio

Tarsi

L 1284 (38.7

R 15425 (35.3) 10.1 prox)

R 15374 (42.0)

inc 15376 prox L (16.9) same size as 15374?

15385-11 L (9.9)

15375-shaft L

15402 prox 5/8 R (9.0 inc)

Femora

R 15373 (55.4) Bd dist 10.7

L 1284 55.3 broken —

R 12XY 56.5 Bd 10.9

R 15365 — " 10.8

Carpometacarpi

~~L~~ 15391 (36.0

L 15373 35.5)

R 15392 34.9

15370 inc 35.0 ?

The specimens now assigned to M. dieganensis include:

	LACM	UCMP	UCLA
Coracoids			
complete	7	1	
incomp.	3		
Humeri			
complete	7	1	4
Prox	9	1	4
Ulna			
comp	4	1	—
prox	4		—
Radius comp	2	1	—
mid	1		
Carpometa	4	1	—
Femur			
comp.	—	1 Type	1
mid	3	—	
prox	1	1	
dist		1	
Tibiotarsus			
complete	5	1	1
dist	4		1
Tarsi			
complete ma.	3	1	
dist.	1		—
Scapula	2	1	1
			1

May 15, 1969

Of previous Mancalla bones studied

L The coracoids (2) LACM 2067 + 2067 are now seen to be of the ? large species, length 48.7 + 51.7

The scapulae

S The humeri (4) on which length could be measured (4) were all of the 4 small forms as now understood
Miller 2269 (56.4); Miller 2218 (65.0)
" 2281 (66.6); Lacm 2096 (63.7

2S/1L The ulnae (3). Two are small sp. LACM 2079 + 2082 (25? 26.3)
one is large LACM 2064 - 33.0mm. (stic max.)

2S/1L The carpometacarpi (3); two are small LACM 2065 (29.8)
Miller 2281 (31.7)
one is large LACM 2060 (35.2 mm)
[Corona del Mar Coracoid is also large LACM 2033 33.2 mm inc 4 est 37.2 est.

L femur (3) large LACM 2097 (50.4) ext length — Rupaal
Miller 2220 (54.2)
Type UC 33409 (56.3)

2/2 Tibiotarsi (5) 2 small LACM 2055 (62.8)
2063 (74.5)
2 large Miller 2294 91.4
Loder 2125 92.7
large? LACM 2177 80.8 (? as Admit one) probably large

L Tarsometatarsi (2) both large LACM 2132 (45.2) still the only
2177 (55.3) two measurable
for length of large size

6.22.64

Following is a list of the specimens both monographed and unmonographed, upon which ~~measurements~~ the present study is based; the numbers in parentheses refer to specimens which are measurable as to length, or breadth at least on articular ends.

Coronado Mesa

San Diego

Skull

Cranium 4

Rostrum 5

Dent/mandible 7

Sternum

Coracoid 43 (22)

Scapula 19

Humerus 133 (105)

Ulna 35 (29)

Radius 10 (7) 1 (mass.)

Carpometacarpus 22 (16) 3 "

Pelvis -

Sacrum 9

Pelvic bones

Femur 32 (19)

Tibiotarsus 55 (44)

Tarsometatarsus 25 (16)

Wing phalanges 4

Pedal " 5

Vert. 20

284
141
425

Humeri	carpus	ulna	coracoid	Radius	femur	tibio	tarso	scapula	sternum
24	6	4 UC	9 UC	2 UC	5 UC	2 UC	4 UC	5	7
9	3	6	6	1	9	11	5+	3	2
6	2	4	5	1	3	5	3	1	5
4	1	2	4	1	1	4	1	2	2
7	1	2	2	1	1	4	1	1	16
5	1	1	2	1	1	2	8	2	
22	1	6	1	7	4	2	1	3	
7	3	1	7		4	9	1	1	
2	4	1	1		2	2	1	18	
7	1	2	4		2	3	1	large	small ?
3	3 UC	3	4		4	2	1		
14	27	2	1		34	2	27		
1	-1 cdn	34	46			7	-1 cdelm		
12 UC	24?		-1 cdelm			1	24		
123	2; OK		45			56			
-1 cdelm						-1 cadlm			
122						55			

30 length

May 1964 Maccalla avail. includes Mello's UC.

	no. specs.	# meas.	small good	small frag.	large good	large frag.	? frag.	Corona del Mar:
coracoid	45	24 (20 length)	13	14	11	3	4	1
scapula	14	14 (11 length)	10		3	1	?	
humerus	132	106 (33 length)	25	44	8	23	6	2
ulna	36	25 (13 length + ends)	21	10	4	1		1
Radius	11	9 (7 length?)	5	1	4		1 not meas in nut	1
Carpometa	21	14 (10 length)	6	6?	8	1		4
Femur	34	23 (7 length)	13	7	8	4	2	
Tibiotarsus	45	~~23~~ 25 (15 length)	13	10	11	3	10 (some small? 4 good)	1
Tarsometa	27	19 (8)	14	6	4		3	3
	365	259	121	98	61 36			vertebra 1

98/19

36/9?

Sternum (manu) 10 meas. 7 (4 clear) small

cran 3 — 11 2 (1 clear) small

up beak 5

art. of lower jaw 3

Sacra 4

vert 18?

quadrate 2 or 3

41

sternum 25 / 44 / 69 ; 31

41 / 14 / 43

224/100

R small (45842 comp)

✓ 2480 inc
✓ 2339 sh
✓ 2332 dist 3/4
✓ 2080 " "
— 2089 " "
✓ 45849 prox 3/4
✓ 2537 prox 3/4 (left in list)
✓ 2280 " 3/4
✓ 2481 " 3/4
✓ 2066 prox 1/2
✓ 2066 " 1/2
✓ 2077 prox (left? in list)
✓ 2538 (or 9) prox (trip)
✓ 2646 prox
✓ 46029 "
✓ 2538 "
✓ 2318 "
✓ 457847 dist 3/4
✓ 45846 " 3/4
✓ 2539 " 1/2
✓ 45847 " 1/2
✓ 2183 dist
— 2339 dist (is This Thousand 2539?)
✓ 2534 " "
✓ 2066 " ("left" in list)
✓ 2183 " tip

unmeas prox small R
✓ 2159
✓ 2103
2066
2066 trip

Left small
✓ 2496 prox
✓ 2289 "
✓ 2206 "
— 2507 "
✓ 2554 "
✓ 2343 "
✓ 2842 "
✓ 2805 "
✓ 2675 dist 3/4
✓ 2206 " 3/4
— 458 47 " 3/4
✓ 2319 " 3/4
✓ 2232 " 3/4
✓ 2644 dist
✓ 6456 dist
✓ 2062 dist
✓ 2063 dist
✓ 2659 inc dist 3/4
✓ 2135 inc dist 3/4
✓ 2081 unmeas sh
— 2672 " "
✓ 2251 unmeas dist
✓ 2065 " ? " tip
✓ 2637 " prox
— 2148 " " (is This 2146?)
✓ 2065 " "

Humeri
grouped by appearance as well as meas
6.24.64

---

measd bone from list to be found Tabulated
L 2505 prox p.3
R 2084 dist p.3
3rd 3 R 2539 dist p.3
2230 sh large? p.1
2314 dist p.1
L 2676 sh p.1 (unmeas.)
R 2084 sh p.1 (")
L 2501 sh p.1 (" large?)
R 2228 dist p.1

L 2643 prox large
check how many 45847
Shaw 2 R 2R (1 L unmeas)
R 45848 dist unmeas
L 45857 " large ?
45850 prox
2892 dist
6181 (2) dist
2819 dist
2093 sh large? p.1
p.4

complete humeri

lacm
ic

- 5 R comps.
- 2 R inc (1 lacks dist. 1 " prox.)
- 1 L comps.
- 1 L inc (lacks dist.)

lacm
uc

- 4 dist R
- 3 prox R (2 are unmeas.)
- 1 sh R
- 2 unmeas prox R

- 5 dist left
- 4 prox left
- 2 sh left
- 1 unmeas prox left

30

meas
- 2 R comps.
- 15 L comps.

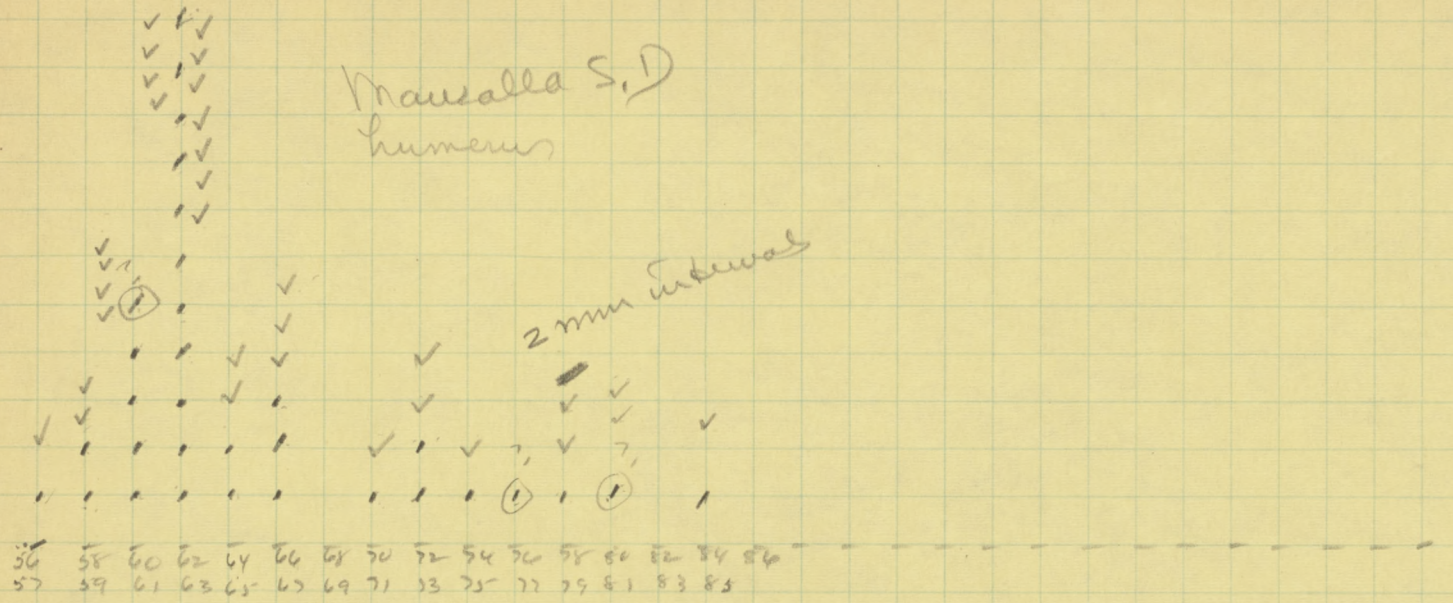
lacm uc

- 4 unmeas. prox R
- 12 meas. prox R
- 2 inc unmeas R
- 10 dist meas R
- 2 unmeas prox left
- 2 unmeas dist left
- 2 " sh left
- 11 meas dist left
- 10 meas prox left

lacm uc

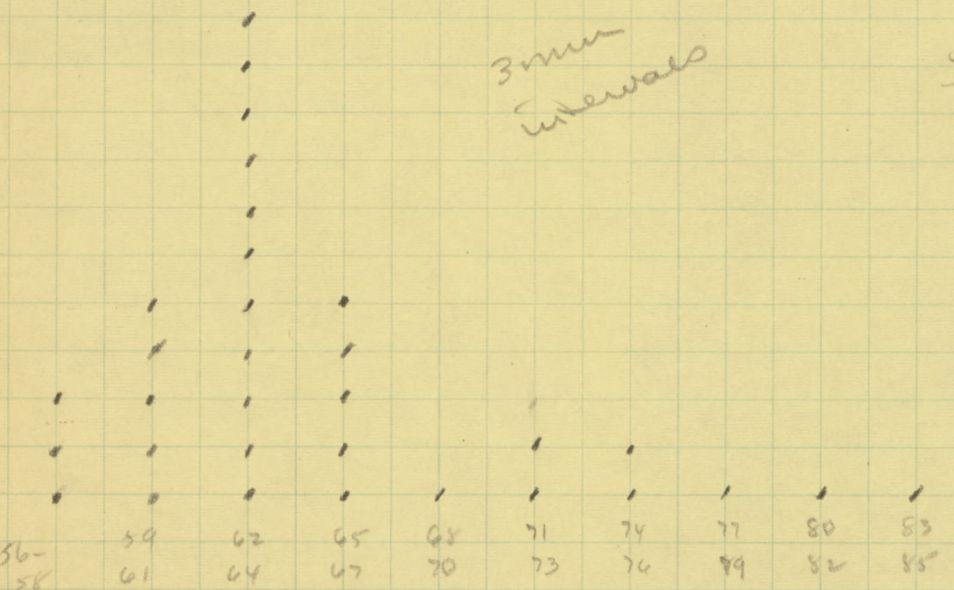
72

Mandalla S.1
humerus



56 58 60 62 64 66 68 70 72 74 76 78 80 82 84 86
57 59 61 63 65 67 69 71 73 75 77 79 81 83 85

56-58 59-61

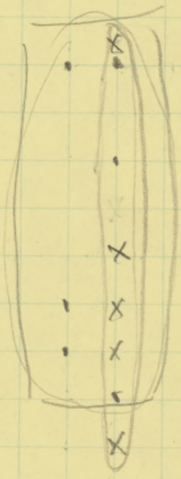


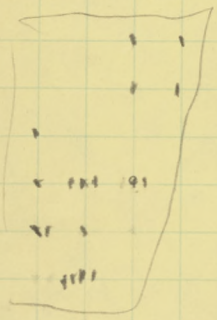
56-58 59-61 62-64 65-67 68-70 71-73 74-76 77-79 80-82 83-85

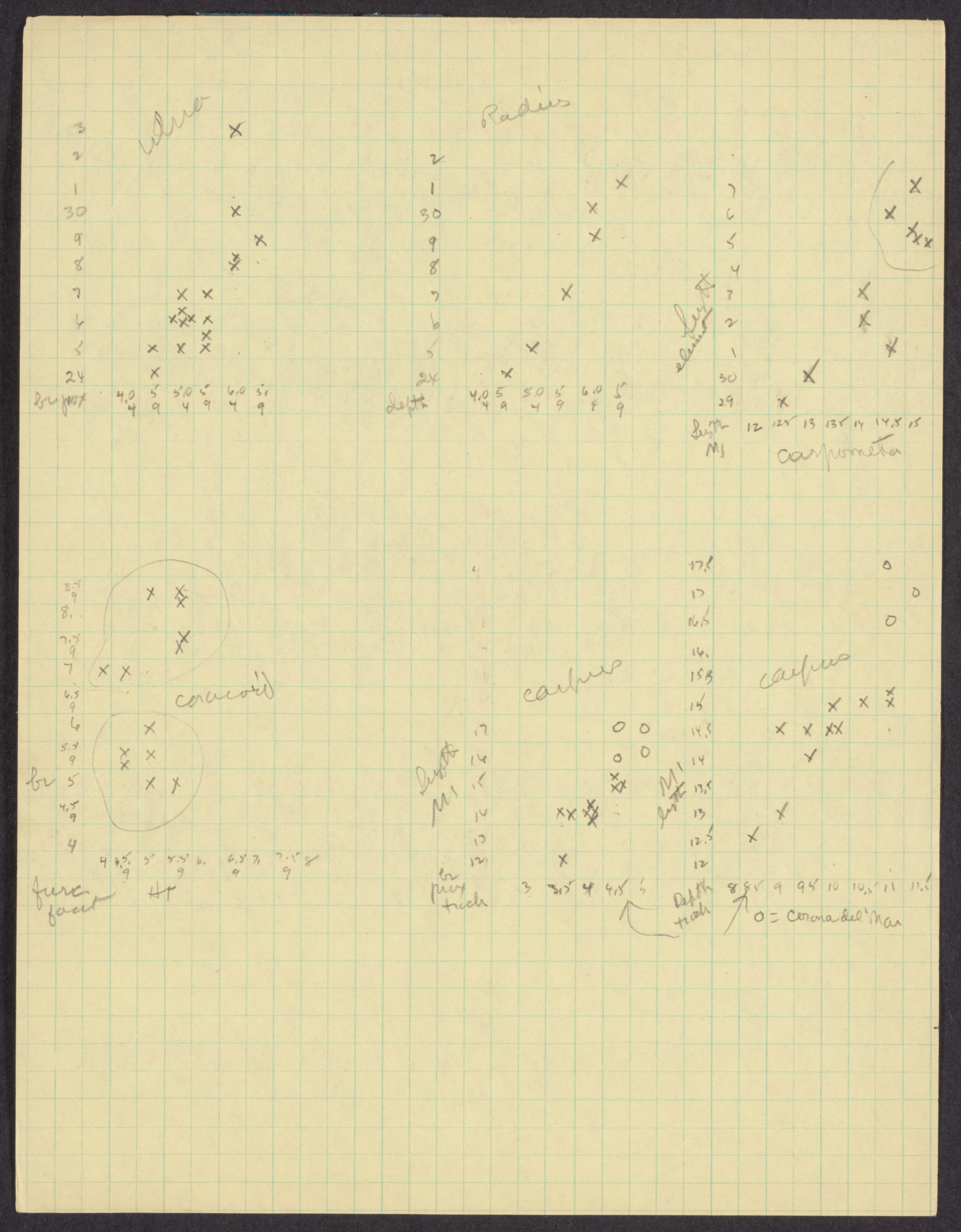
66
56
10

80 80+
68 70.9
12 10

85
71
14






ulna
Radius
Light elbow
carpometa
coracoid
carpus
carpus
Depth track
O = Corona del Mar

Earth Science

Interchange with Life Science

Provincial

Chief Curator (V.P.)

Vert. Paleo

1 Curator ~~Higher Vert. Paleo~~ Land Mamm (Sr. Curator)

3 Assoc. Curator, marine Mammals

2 Curator, Amph. Rep (~~and Fishes~~)

5 Curator, fossil Birds ~~or fishes~~

4 Curator Assoc. Cur fossil fishes

Preparators

Head Preparator and fossil man

Sr. Preparator and " "

Preparator (Fossil)

~~Preparator (Invert. Skel)~~

(Clean prep in solutions for V. P.)

Scientific Illustrator

Archaeology (Anthro. in history)

Curator

Preparator

Invert. Paleo

Cur - Mesozoic

Cur - marine

Preparator

Mineralogy (2/3 time)

Curator

Assoc or Asst. - 1 more room

Paleobotany

Curator

Preparator

Special Collections Staff

Sec. - Steno Clerk - 2 off (1 res area)

Sec Clerk 1 "

1 "

1 "

1 "

Provincial

"

"

"

~~Preparator Sc. Skel.~~

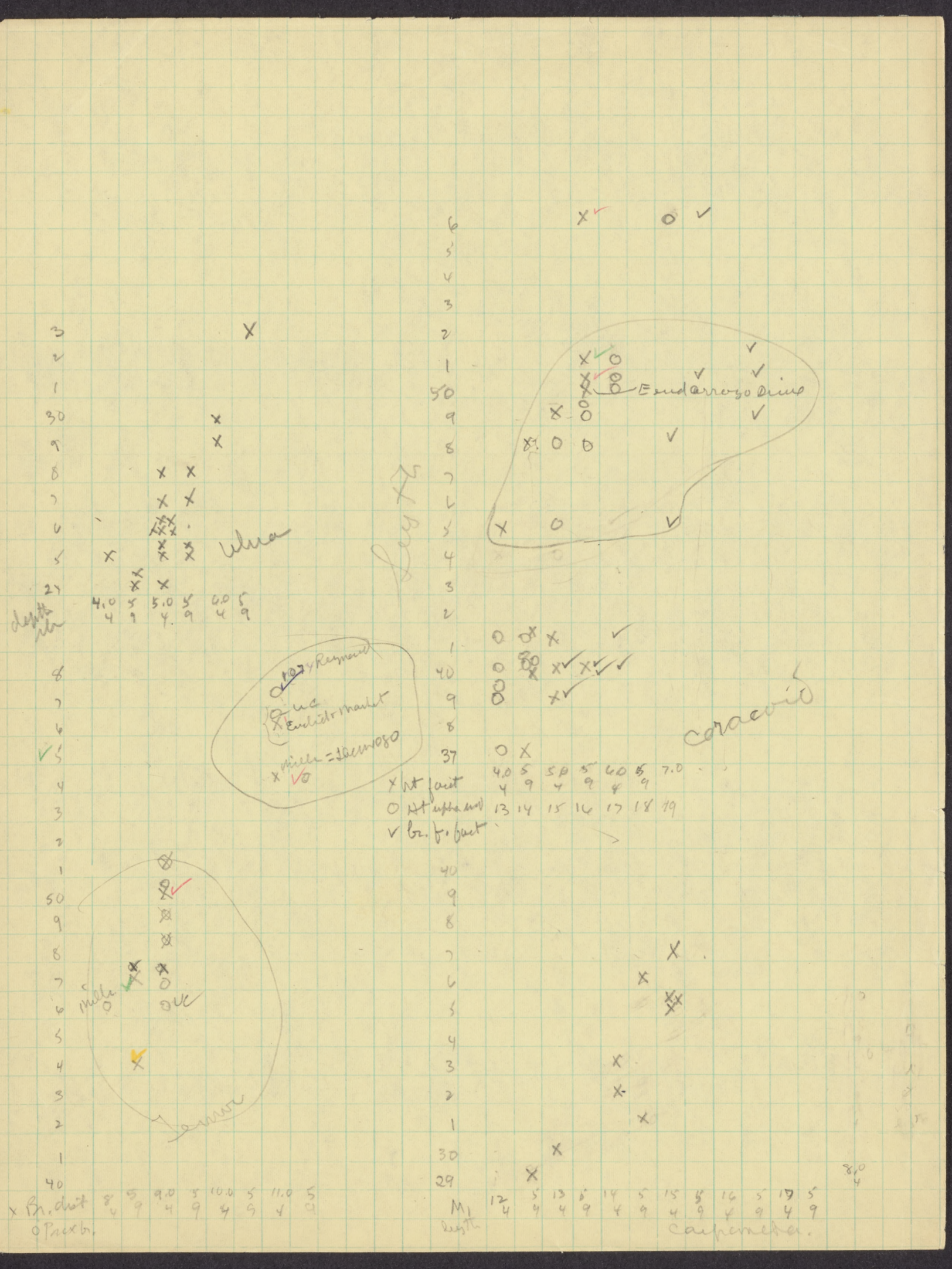
Sec 1 off

1 off emp

Sec

Sec.

Hancock


Endarroso Dino
Ulna
Radius
Femur
coracoid
Br. dist
Pr. br.
M1
depth
calcaneus.

Invertebrate Paleo

Personnel

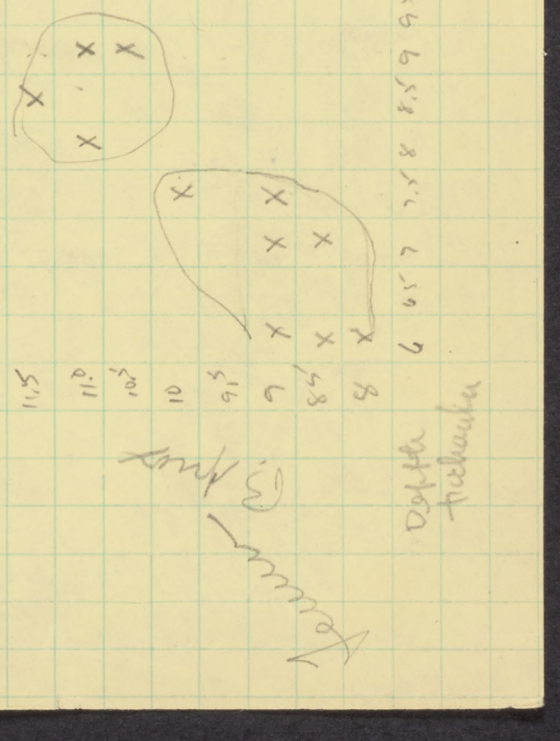
Curator

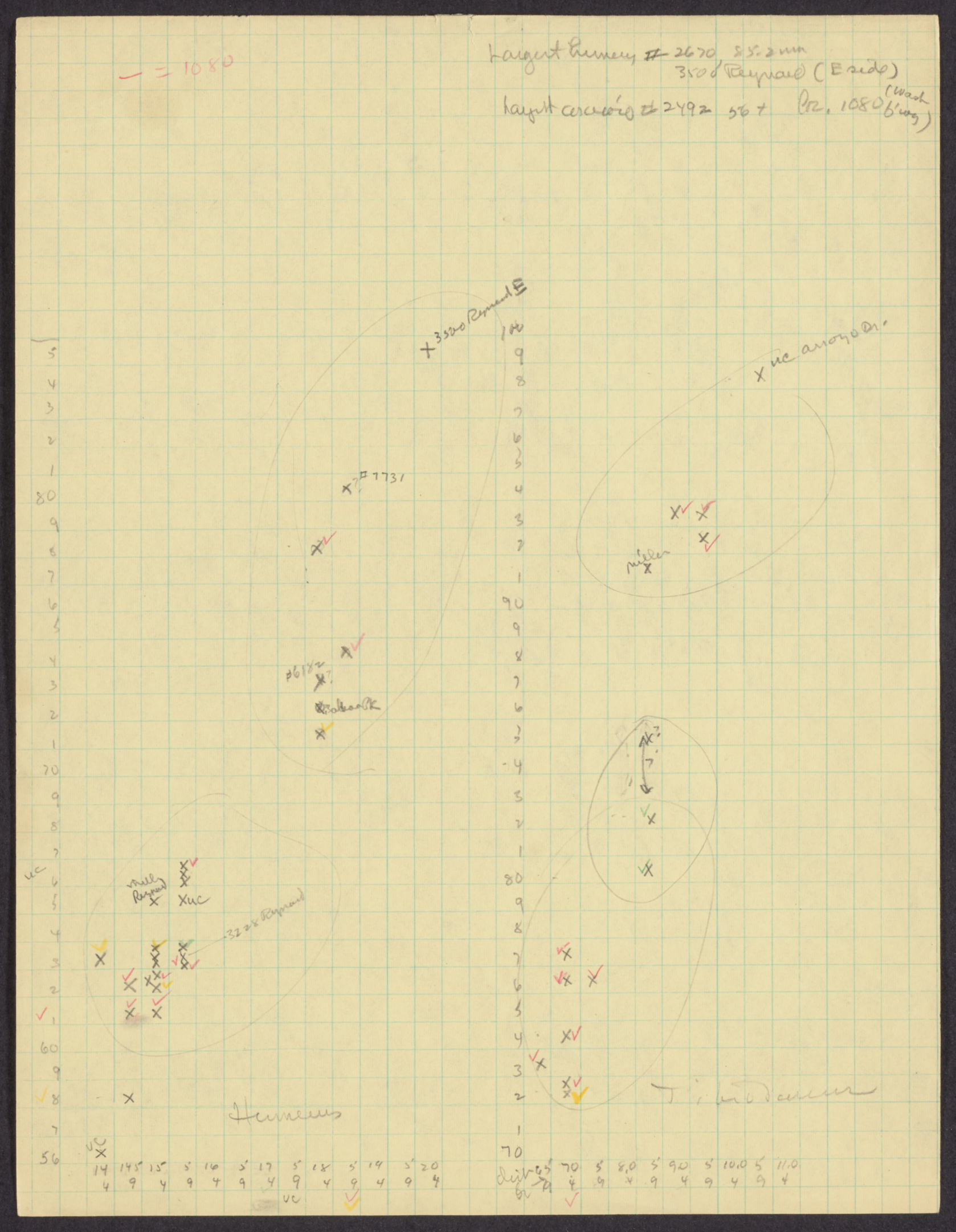
Mineralogy

Curator

Assist

Hancock Park




— = 1080
Harvard Square #2670 85.2 mm
350 d Raynaud (E side)
Harvard Observ #2492 56 + Pr. 1080 (wash 6 ways)
+3500 Raynaud E
#7731
#6182
Holden CK
Muller
Xuc
Xuc
Muller
Raynaud
+3228 Raynaud
Harvard
Tinsdale
14 4
14 5 9
15 4
5 9
16 4
5 9
17 4
5 9
18 4
5 9
19 4
5 9
20 4
5 9
70 4
5 9
8.0 4
5 9
9.0 4
5 9
10.0 4
5 9
11.0 4

56.4
58.1
58.7
3

3)173.2
57.7

56.0 – 57.9 – 1
58.0 – 59.9 – 2
60.0 – 61.9 – 4
62.0 – 63.9 – 11
64.0 – 65.9 – 2
66.0 – 67.9 – 3
68.0 – 69.9 – 0
70.0 – 71.9 – 1 } 3
72.0 – 73.9 – 2 }
74.0 – 75.9 – 1 } 1
76.0 – 77.9 – 0 }
78.0 – 79.9 – 0 } 1
80.0 – 81.9 – 1 1
0
1

Herbivore

Marine mammals?

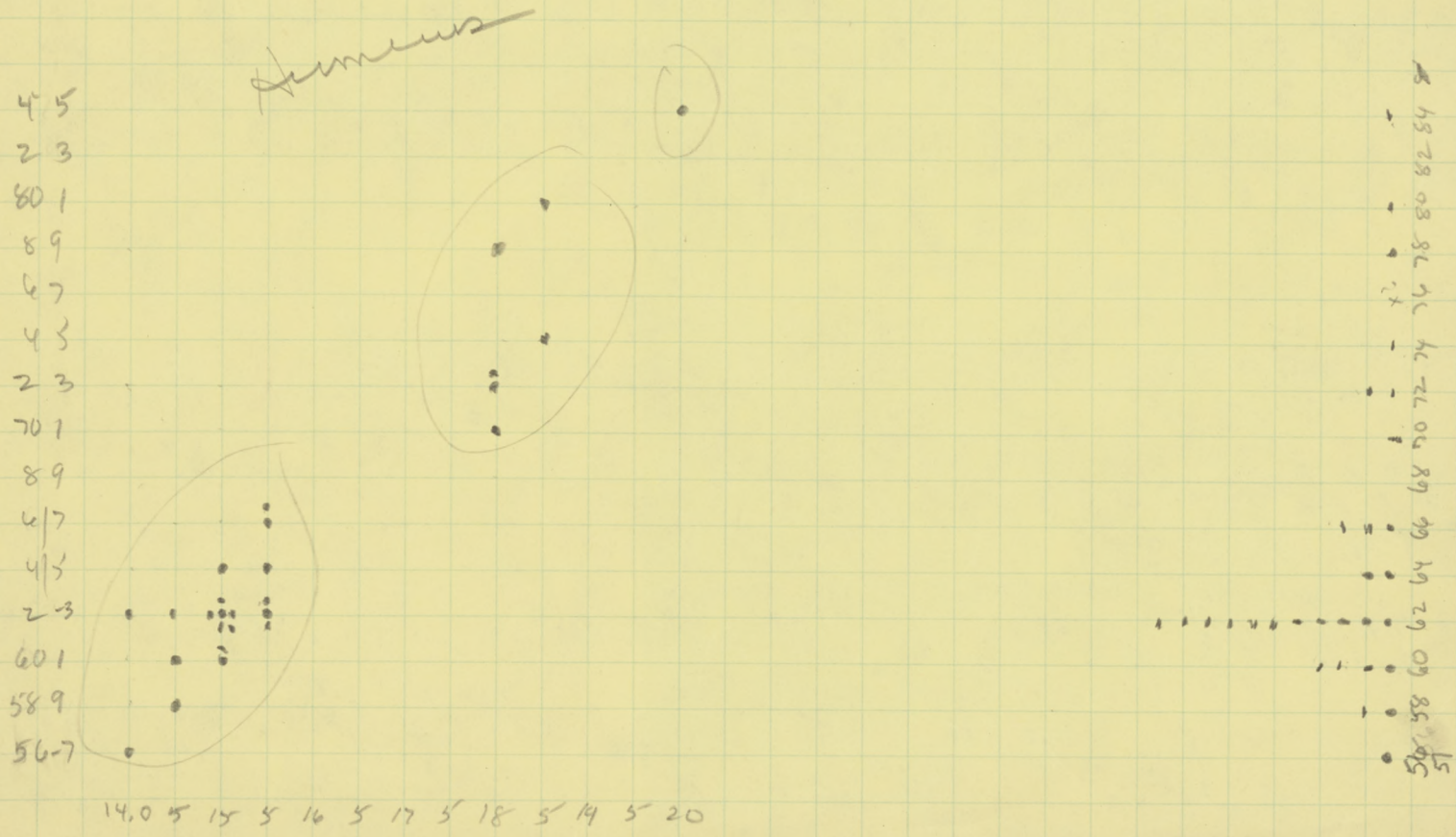
Predator

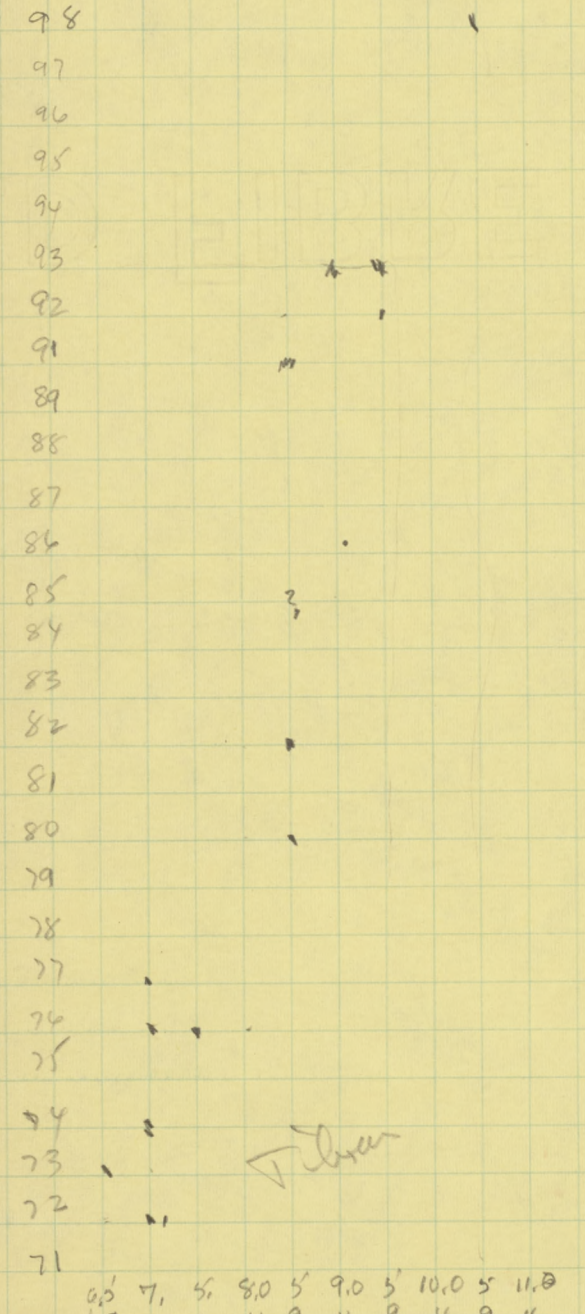
Predator

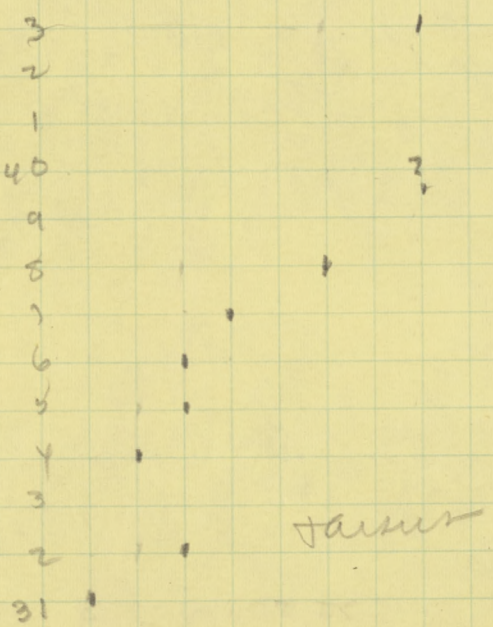
Predator

Predator

Predator


4 5
2 3
80 1
8 9
6 7
4 5
2 3
70 1
8 9
6 7
4 5
2 3
60 1
58 9
56-7
14.0 5 15 5 16 5 17 5 18 5 19 5 20





$$448\overline{)563} \quad 1.25$$

$$\begin{array}{r} 448 \\ \hline 1150 \\ 896 \\ \hline 2540 \\ 2240 \end{array}$$

$$426\overline{)531} \quad 1.24$$

$$\begin{array}{r} 426 \\ \hline 1050 \\ 852 \\ \hline 1980 \\ 1704 \\ 170 \end{array}$$

Scapula

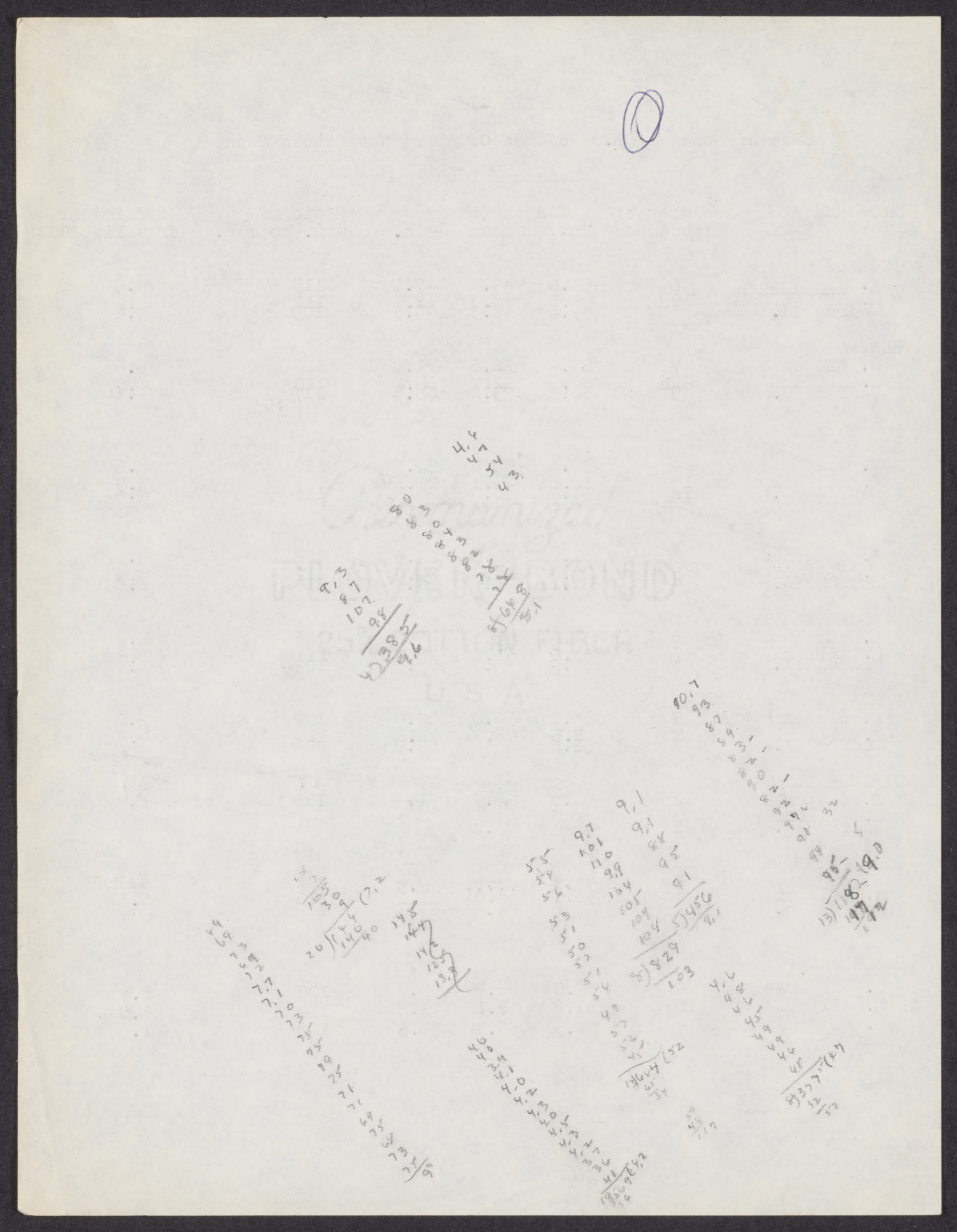
M. diegense 14.4 13.4 12.2
M. milleri 11.8 10.9 10.3

TABLE ~~III~~ IV

Size of Bones of M. diegense Compared With those from Cedros Island

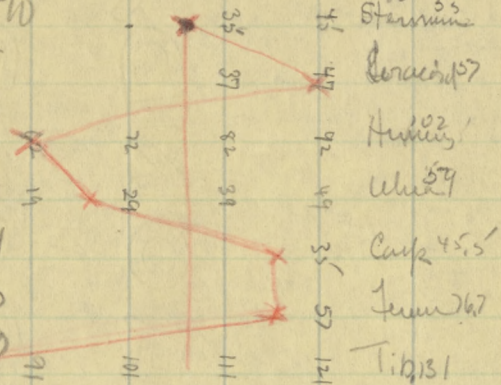
Elements	Number of specimens	Length (in mm) Max.	Mean	Min.	Ratio of max. to min.	Coefficient of variability
CORACOID						
M. diegense	6	54.0	49.4	47.7	113 %	4.8
M. milleri	9a	43.5	40.0	38.5	112	3.4
Cedros Id.	3	47.5	45.3	43.5	109	4.4
HUMERUS						
M. diegense	7	85.2	76.5	71.0	120	6.6
M. milleri	23b	66.6	62.7	56.4	118	4.8
Cedros Id.	8	80.0	73.0	68.5	117	4.6
ULNA						
M. diegense	4	32.0	30.0	28.5	112	5.6
M. milleri	14	26.6	25.5	23.1	113	3.9
Cedros Id.	12	31.8	30.0	28.5	111	4.4
RADIUS						
M. diegense	3	31.8	30.0	29.5	108	5.1
M. milleri	5	27.0	24.5	24.0	112	4.5
Cedros Id.	4	31.1	29.3	27.3	114	6.6
CARPOMETACARPUS						
M. diegense	5	37.1	35.8	35.0	106	2.2
M. milleri	7	33.8	31.6	29.7	112	4.1
Cedros Id.	4	36.0	35.4	33.6	107	1.4
FEMUR						
M. diegense	5	53.6	52.0	50.0	107	2.7
M. milleri	8	48.6	45.7	42.6	114	4.3
Cedros Id.	2	52.8		52.0		
TIBIOTARSUS						
M. diegense	6	98.5	93.7	91.4	108	3.0
M. milleri	7	82.0	74.9	72.5	113	4.7
Cedros Id.	1		83.8			
TARSOMETATARSUS						
M. diegense	3	43.6	40.8	38.3	114	6.5
m. milleri	6	36.1	34.5	31.1	116	6.6
Cedros Id.	3	42.0	39.2	37.3	112	6.2
FEMUR (gr.length						
M. diegense	4	57.0	55.3	53.8	106	2.2
M. milleri	10	51.2	48.9	44.9	114	4.5
M. cedrosensensis	3	56.5	55.4	54.5	102	1.6
Tibia alt	5	98.5	93.7	91.4	108	3.0
diegense						
milleri	9	83.0	76.5	72.5	114	4.7
Cedros	1		83.8			

Tibia



1947 work

	Mallard (Anatidae)	Gallus domesticus	Anas Platyrhynchos domestica	Sphenisc. demersus	Struthio camelus
Sternum	97.5	107	116.7	103	141
coracoid	112	140	146	100	129
humerus	68	58	115	123	109
ulna	37.4	58	87	143	129
carpus	69	66	99.3	106	124
femur	104	119	147	79	110
tibiotarsus	87.4	88	145.5	128	100
Tarsus	100.9	64.3	133		



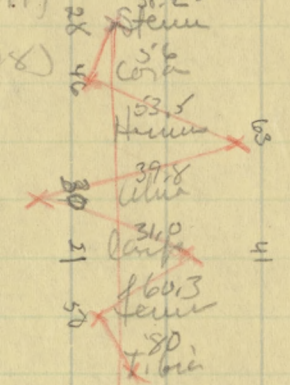
left tarsus

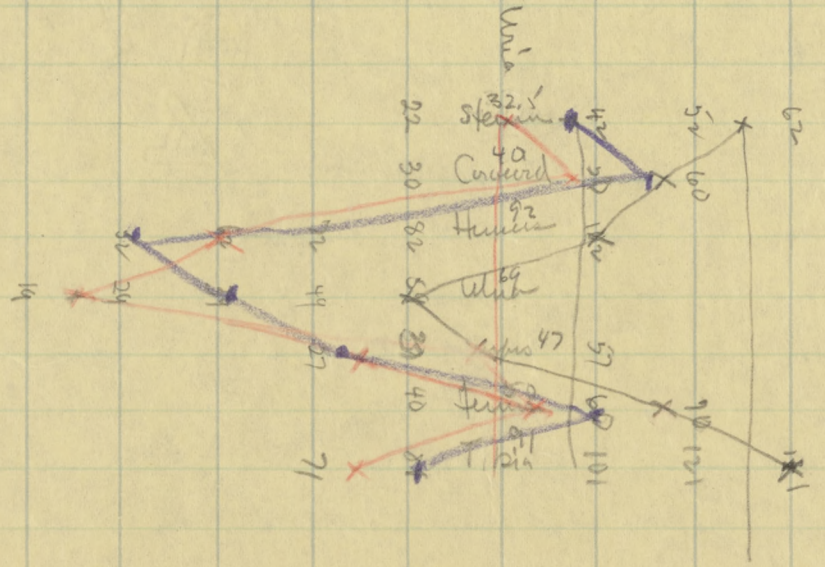
Mallard 38.3 (#2127)

" 43.6 (2178)

2 | 81.9

40.9





Mallard

97.5 = 100%

112 = 114

68 = 70 (-)

37.4 = 37

69 = 70 (+)

104 = 106

87.4 = 89 (+)

100.9 = 103

No. 613, University Book Store, Los Angeles

sternal breadth
length coracoid
" humerus
" ulna
" carpometacarpus
" femur
" tibiotarsus
" tarsus

Ulna
Femur
Humerus

The straight line represents the average
Curve of Ulna. The dotted curves indicate
the deviations from Ulna on the part of
Femur + Humerus respectively.

	Mann	Penguin	Platte
% bet. Sternum + cora	14%	35	29
" " " humerus	30%	50	03
" cora " "	4%	82	30
" " " ulna	72%	82	60
" humerus " "	30		28
" " " carp.	01		16
" ulna " "	30		12

Parallel lines Platte
Purple = Penguin
Red = Mannikin

Sternum
cora
humerus
ulna
carp
femur
Tibia

20 30 40 50 60 70 80 90 100 110 120 130 140

55-59 60-64 65-69 70-74 75-79 80-85

length humerus 1964 big

1964 big
br. hum - humerus

① lines on left edge represent intervals of 5 - can they be started at level of the long straighter line instead of straddling it?

② confusion of × for portion of Plantus + Urea
Omit × on long line - don't need them for Urea.

may 1965

Family MANCALLIDAE established

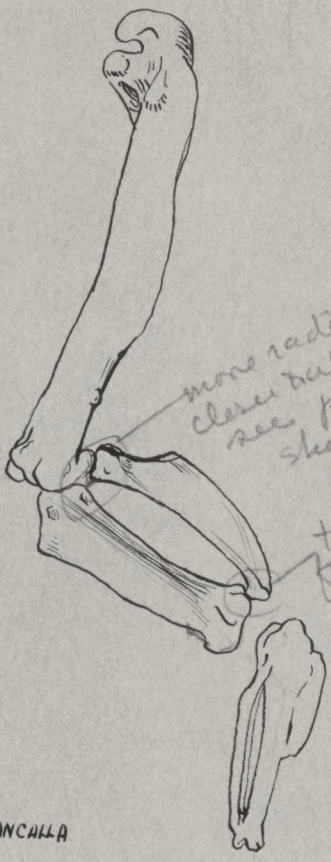
Distinguishing characters of humerus of Mancalla from Miller, 1946:34

"Although we have a humerus that is fundamentally auk-like, the compression is extreme, the external and internal tricipital grooves are profound and are sharply defined by blade-like ridges, the arti cular condyles are reduced and they are brought together and shifted in position, so that they lie in a line that has rotated from the transverse direction seen in the majority of birds to one far nearer the sagittal plane of the bone, much as we see it in the penguins. The effect must certainly have ben a marked reduction of freedom in the elbow joint. Pronation and supination must have practically disappeared, while flexion of the forearm upon the upper arm could scarcely have been effected. There must have resulted a penguin-like swimming flipper rather than an organ of potential flight that could be folded away in typical bird fashion when its owner came to rest. The recession of the epicondylar prominence up the shaft suggest prolonged extension of the metacarpus, thus adding further to the impression of flipper type of limb." ..... "Examination of this new material reveals such positive modification of the distal portion of the bone [humerus] as to make it necessary to recognize the family Mancallidae if we are to harmonize the taxonomy of fossil birds with that of Recent ornithology."

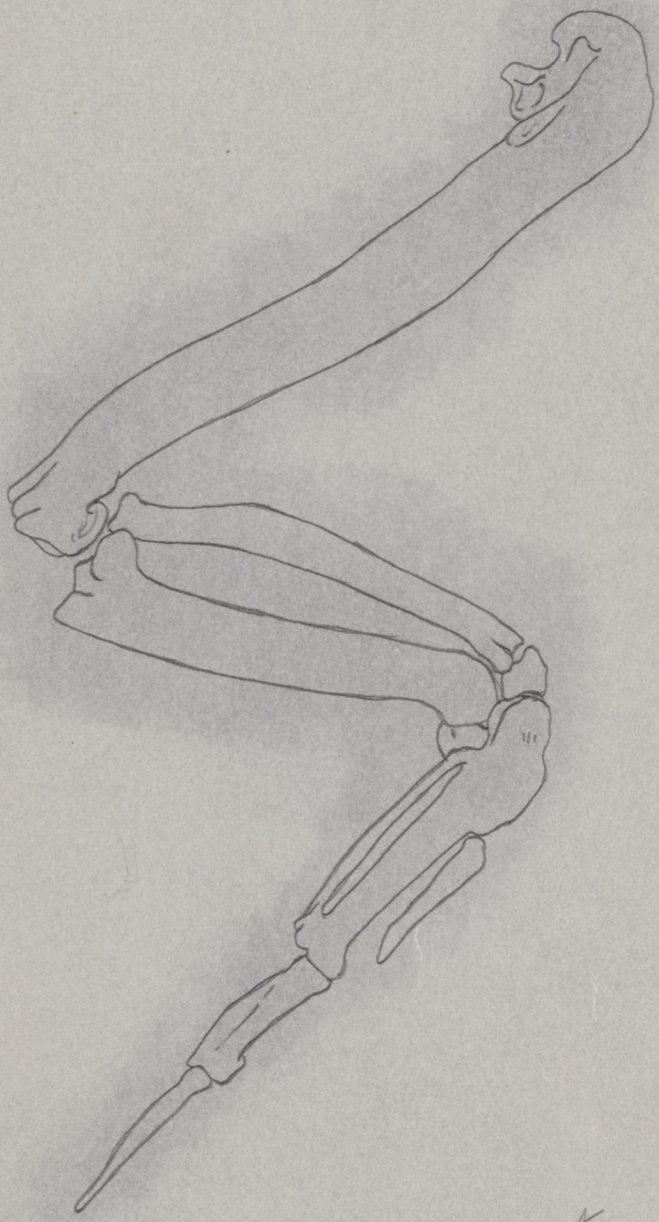
Includes all monographist + new & G.M.

* = measured

	All		✓	Large		✓	Small		✓	* meas. ✓
	max	min	aver.	max	min	aver.	max	min	aver	aver.
Humerus (ext. length (23)	85.3	*56.4 mean	67.0 (23)	85.3	71.0	77.4 (7)	*66.6 mean	*56.4 mean	62.7 (18)	62.3*
Coracoid (16) middle length	56.5 (5) ?, 1964 or ?, 1964	37.0	44.8 (~~14~~ 39) or 1964	56.5	*48.7 meas.	50.8 (7)	41.7	37.+	40.1 (9)	46.8
Ulna (gr. length) (3)	*33.3	25.3	27.7	33.3.	29.6	32.4	27.5	25.3	26.2	27.2
to inter cot. ridge (1) (length est'd specimen)	*31.6	24.0	25.7	31.6	28.0	28.8	25.8	24.0	24.6	25.8
Radius (4)	29.8	24.8	27.8							
Tarsometa tarsus gr. length ~~obtyl~~	*43.7	32.6		*43.7			37.1	32.6		
	*43.5	32.5		*43.5			37.0	32.5		
Cathartes (5) aura s.l.	37.2	*29.8		37.2?	35.2?	36?	31.7?	*29.8		32.3
c.d.m.	41.3	?	?	41.3						
Tibiotarsus	92.7 (94?, est.)	71.6								


move radius closer to ulna see pencil sketch
touch up from reverse side of radius (remember? This is a left radius we are using on the right side!
MANCALLA

use this
We found one of the little carpals (see specimen!)
↑ supernimposed pencil sketch



great auk

1) The Pliocene Bird Mancalla
by Loye Miller & Hildegarde Howard

2) The Flightless Diver, Mancalla.

3) The Flightless Pliocene Diver Mancalla

Introduction

Acknowledgments – Geologist Kennell
Squires + ~~Cornett~~
Kanakoff.
Frank Gander

Material available
Amount, parts, ratio of parts recovered
State of preservation, wear, fracture etc.
Localities represented.

Matrix +
Physical nature – color, granulation
Stratification, sorting.
Conditions of deposition.

Associated faunas – Vertebrate, Invertebrate
Micro fauna
Conclusions as to age
Los Angeles, Newport, San Diego.

Detailed study of the remains.
Pectoral assemblage
Sternum, Coracoid,
Humerus, Ulna, Radius, Manus.
Pelvic assemblage
Pelvis,
Femur, Tibia ~~+~~ Tarsus.
(Relation to Plialunda.

Phases of special interest
Historical, Geological, Biological

Summary.

UNIVERSITY OF CALIFORNIA AT LOS ANGELES

INTERDEPARTMENTAL MEMORANDUM

Signed:.....

Date:.....

LA-C-24A-15m-8,'36

821 CHERRY LANE
DAVIS, CALIFORNIA 95616

15 May 1970

Dear Hildegarde:

Perhaps you can advise me. Among Padres things are a little vials of fossils which are carefully labelled & perhaps should be with you or someone else. They may of course be duplicates but if they are important I want to put them in the correct hands.

3 bones ① { Mancalla diegense (Miller) / Mancalla californica Lucas } these are greyish.
Cudyptula — a white bone

Location: San Diego Formation, Pleocene
5 Points Freeway Site

By: Jos. F. Arndt

821 CHERRY LANE
DAVIS, CALIFORNIA 95616

(2) 1 bone
Mancalla cedroansis Howard
Pliocene, Cedros Id, Mex
Collected by Robt Jones 1969
to Loye Miller, by exchange

Geo 69-53
Zool RCJ

(3) 2 bones & 2 fragments
2365 (on one bone
other #s I can't read)

Chendytes lawi Miller
Pleistocene Anacapa Id; Cal.
Ed Mitchell & Gene Lippa, Col.
1960

These all must be fossils of recent papers
yours on Mancalla w/ Padre & the
later Chendytes one.

821 CHERRY LANE
DAVIS, CALIFORNIA 95616

Should I send them to you?
Or should they go to:
Arndt
Robt Jones ?
Ed Mitchell

(If I can find their addresses)

I'll appreciate your help.

In haste

+ best wishes

Alice

List of illustrated specimens 1949

Plate 1

fig. 1 + LHM 2218 humerus milleri + fig. 2 LACM 2082 ulna milleri + fig. 5
+ + LHM 2220 radius + fig. 4 milleri + fig. 3 2064
+ LACM 2069 ulna milleri +
+ LACM 2065 carpus + fig. 3 milleri 29.6 +
7, fig. 4 LACM 2158 phal.

Plate 2 + fig. 1 LHM 2249 Humerus milleri +
✓ fig. 2 LACM 2066 " ulna ~~milleri~~ diezeuxis ✓
+ fig. 3 LACM 2096 " — milleri +
+ fig. 4 LHM 2281 " — milleri max?, +
? fig. 5 LHM 2281 Pelvis milleri fig. 8 LACM 2076 fig. sternum ? ?
+ fig. 6 LHM 2220 Sternum milleri? + fig. 7 LACM 2063 sternum milleri ? +

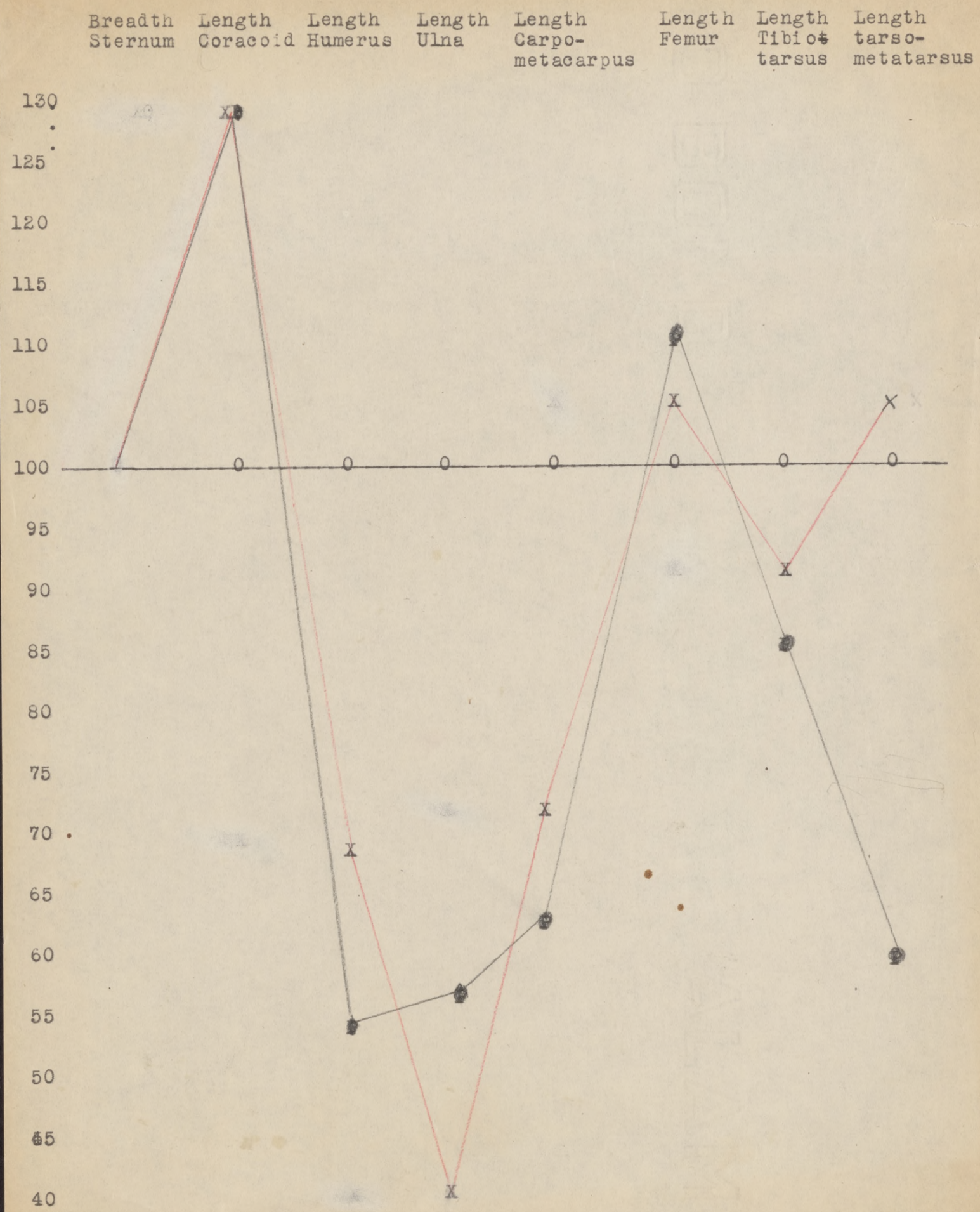
Plate 3 fig. 1 LHM 2220 coracoidine
✓ fig. 2 LACM 2087 " coup diezeuxis
✓ fig. 3 " 2067 " " diezeuxis
? fig. 4 LACM 2054 mandible
✓ fig. 6 LHM 2220 humerus dist. diezeuxis
✓ fig. 7 LACM 2064 ulna diezeuxis
+ fig. 8 LACM 2082 ulna milleri +
+ fig. 9 LACM 2079 ulna milleri +
+ fig. 10 LACM 2101 ulna milleri + 23?

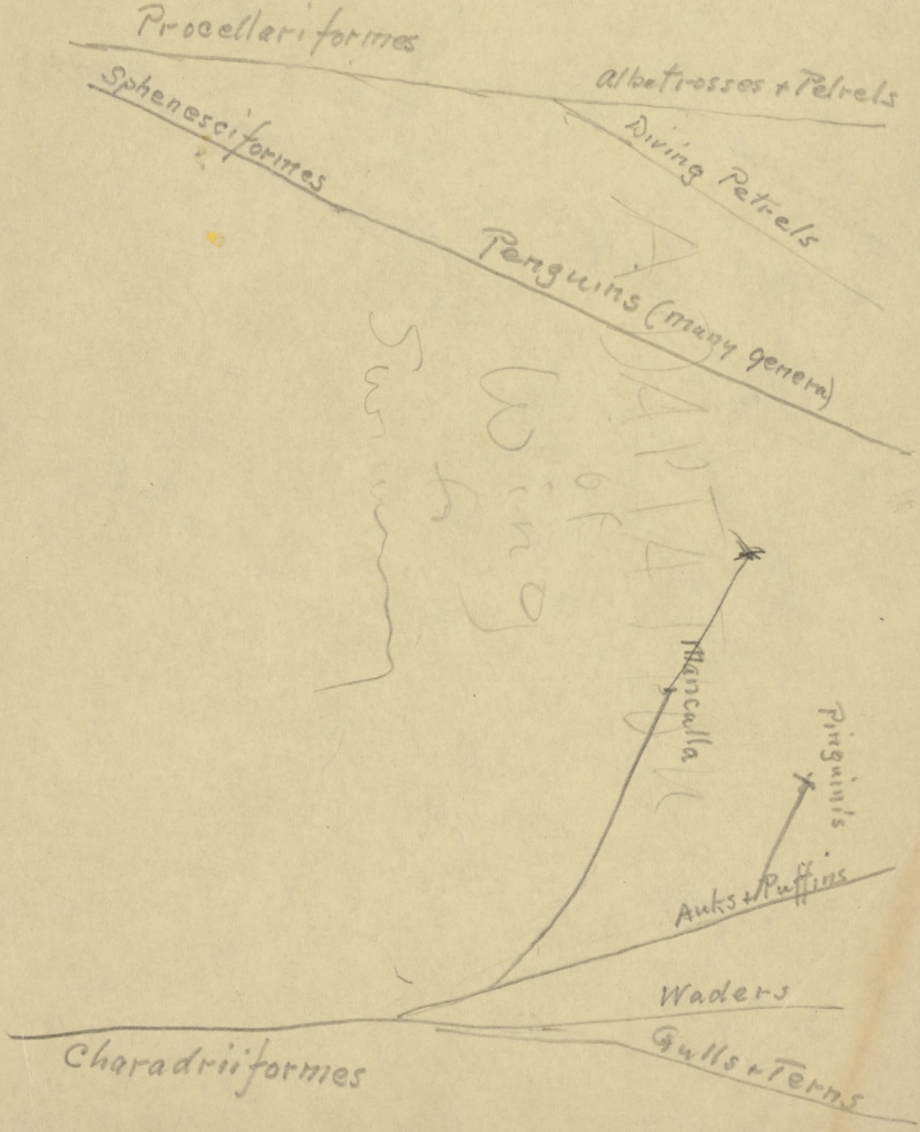
fig. 11 Taxmeta. LACM 2091 milleri
12 Taxmeta LACM 2091 (2 milleri 8 spec.)
13 up. mand. LACM 2107
✓ 14 humerus LHM 2220 diezeuxis

Plate 4 + fig. 1 LACM 2097 femur milleri + + fig. 8 tibia LACM 2083 milleri +
✓ fig. 2 LHM 2220 femur diezeuxis ✓ ✓ fig. 9 " " 2125 diezeuxis ✓
+ fig. 3 LHM 2220 radius milleri 24.9 + fig. 10 " " 2100 milleri +
+ fig. 4 LACM 2050 scapula ✓ fig. 11 " LHM 2220 (1) diezeuxis ✓
✓ fig. 5 LACM 2176 scapula milleri + fig. 12 " 2220 (2) milleri
+ fig. 6 LHM 2220 scapula diezeuxis ✓ + fig. 13 " LACM 2108 milleri +
✓ fig. 7 LACM 2049 scapula milleri + fig. 14 " " 2134 milleri +
~~milleri~~ 12.2 ? + fig. 15 carpus LACM 2065 comp milleri +
diezeuxis ✓ + fig. 16 " " 2065 mic. diezeuxis ?
+ fig. 17 " LHM 2281 milleri +

Plate 5 ✓ fig. 1 LACM 2177 tibia diezeuxis ✓
+ fig. 2 LACM 2179 ulna milleri +
★ fig. 3 LACM 2185 femur milleri type ★ TYPE
✓ fig. 4 LACM 2178 tarsus diezeuxis ✓
✓ fig. 5 LACM 2177 tarsus diezeuxis ✓

Plate 6 + fig. 1 LACM 2180 sternum milleri + +
+ fig. 2 LACM 2182 pelvis milleri +


Breadth Sternum
Length Coracoid
Length Humerus
Length Ulna
Length Carpo-metacarpus
Length Femur
Length Tibio-tarsus
Length tarso-metatarsus
130
125
120
115
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40


Procellariformes
albetrosses + Petrels
Diving Petrels
Sphenesciformes
Penguins (many genera)
Mancalla
Penguins
Auks + Puffins
Waders
Gulls + Terns
Charadriiformes

The Lucas Auk's Golden Jubilee.

by Loye Miller and Hildegarde Howard

It was a small beginning and seemingly of little significance when the fragment of bird bone from Third Street Tunnel in Los Angeles was sent to Dr. F. A. Lucas at the National Museum in Washington but — how short a distance we can see into the future or into the material face of a cliff of fossil bearing sandstone. The Third Street tunnel was driven through a line of hills that limited the growth of tiny Los Angeles ~~in its pressure~~ to the westward from Broadway. Now fifty years later the insatiable young city has reached the sea fifteen miles to the west and has enwrapped several smaller communities with its amorboid pseudopodia. Alas and alack! but we must have progress.

~~But~~ There is, however, no regretful shake of the head to deprecate our offending and insatiable thirst for knowledge ~~and understanding~~ of our lords — past or present. That is why we are here today.

There was only on fragment of one bone taken from that ~~whole~~ Third Street bore fifty years ago. Engineers are now throwing the whole range of hills around in their restless squirming, and still no more bones to cheer the paleontologist. Nevertheless we Students of Marcella have reached the sea fifty miles away at Corona del Mar and more than once hundred miles away at San Diego.

The Lucas Auk has thrust back his restraining barriers even more effectively than has the "Pueblo de Nuestra Señora"

In resume then we would say that:—

1- Mancalla is now known to have occurred in three geographical localities and eight different exposures all of which are of approximately the same phase of the Pliocene epoch.

2- San Diego, one hundred and forty miles south of the type locality has yielded all but five of the specimens thus far recovered. Our latest previous study recorded 132 bones. San Diego has since added about 80 specimens Los Angeles and Corona del Mar have yielded none.

3- Our former contention that a larger species, californiensis of Lucas, was confined to the Los Angeles and Corona del Mar areas and that the San Diego species, diegense of Miller was restricted to the southern area, is now abandoned. The greatly increased representation proves us to have been.

4- As to whether all our Mancalla specimens should be referred to one species, we are not even now entirely at ease. Lucas' detailed examination of tremendous series of a single species, the ~~finetis~~ great auk, all taken from one locality, shows a marked range in size variation. Since the Great Auk had seemingly reached the stage of gigantism in its evolution this variability is not surprising. Mancalla on the other hand, is a smaller bird but, if the series were considered to represent one species, the size variation would be far in excess of that seen

in the Great Auk. This fact alone should give us pause.

5 - The humerus is the most characteristic bone and fortunately it ~~is the segment that is represented by the greatest~~ has been recovered in greatest numbers. When arranged in a graded series the humeri fall into two groups - a shorter but variable group and a longer and about equally variable group. The hiatus between these two groups is great enough to strongly suggest specific distinction.

6 - Is it likely that two distinct species would occur on the same sand spit which we have postulated as a "loafing ground"? It appears to me that such might readily have been the case - especially if we consider the southern locality to have been a wintering ground to which the northern and larger form may have repaired in numbers far less than did the smaller local species.

At any rate we have in Mancalla a most fascinating bird ~~and~~ about whom we still have much to learn (and what could be more facinating than an unsolved problem?)

Let us carry on!

Thank You

who spawned him. He was christened as Mancalla californiensis and was nearly nine years old before another fossil bird was born into the household of the state whose name he bears. I wish the good Dr. Lucas could drop in from his field camp somewhere along the Milky way - the path of the gods toward Mt. Olympus - and see how his God child has grown.

Lucas published this paper with little expectation of ever seeing additional material. Not until after the close of his distinguished career was a second and even tinier fragment recovered from a new field in San Diego. This was followed by others in more rapid succession until we have now come to reject Mancalla and three years ago we felt justified in presenting a general paper on the genus (Published in '49 by Carnegie). At that time we had a fair representation of most of the critical parts of the skeleton. The subsequent three years have however increased the collections by fully fifty percent and we feel justified in re-examining the evidence

pencil nos. above are The included Miller bones)

Analysis of the skeleton of Mancalla

2

Material Available assigned to

The following skeletal elements ~~of~~/Mancalla ~~xxx~~ are now available: ~~(109)~~ 121 (~~27~~ 6 are miller's) (94 Lam. of which 4 are Cor. del mar)

of which # are Miller's 12 (11)

Humeri, ~~4~~ 3 complete, ~~13~~ 5 incomplete, ~~9~~ 3 fragments 33

Ulnae, 1 complete, 3 nearly complete 4

Radii, 1 complete 1

Carpometacarpi, 2 complete, 6 incomplete (from coronado del mar) 8 (1)

Wing phalanges, 1 (D3 P1) 1

Carpals, 1? (Ulnar) 1

Sterna, 1 nearly complete, 6 fragments 7

Scapulae, ~~2~~ 5 nearly complete, 2 fragments 7 (2)

Furculae, 1 fragment 1

Coracoids, 2 complete, 2 incomplete, 2 fragments 6 (1)

Skull, 1 beak?, 2 articular ends of lower mandible 3

Pelvis, 1 incomplete, 2 fragments pelvis, ~~xxxxxxx~~ 3

Femora, ~~3~~ 2 complete, ~~3~~ 2 incomplete, 4 fragments 11 (4)

Tibiotarsi, 2 complete, ~~10~~ 13 incomplete 15 (4)

Tarsometatarsi, ~~1~~ incomplete, 2 fragments (2 are from coronado mar) 7 (2)

Vertebrae, 5 cervicals, ~~4~~ thoracics, ~~2~~ 4 sacra separate from pel. 13 (2)

(1 is from Coronado Mar)

121

Of these the following are large

2 humeri (inc.)

1 carpus (inc. Cor. del mar)

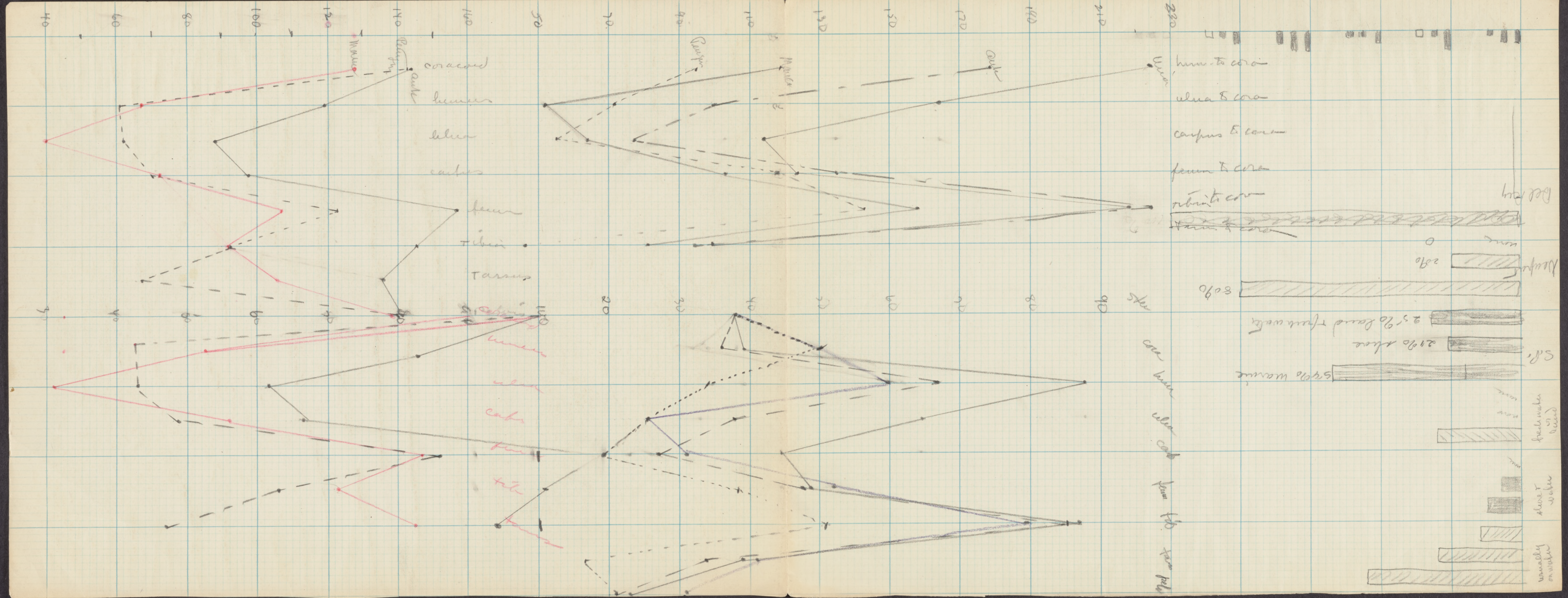
1 tibiotarsus (comp)

1 cerv. vertebra

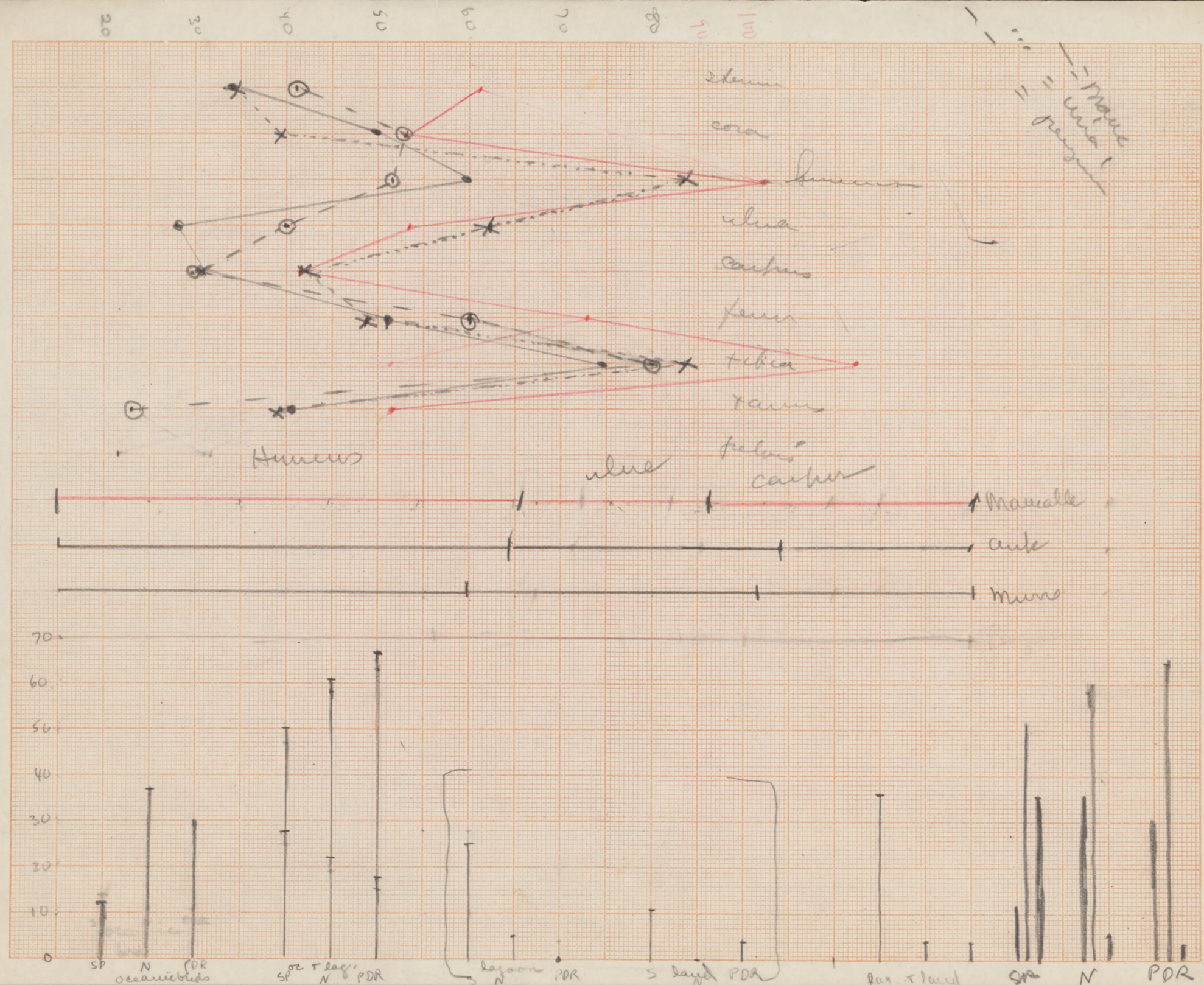
74.5

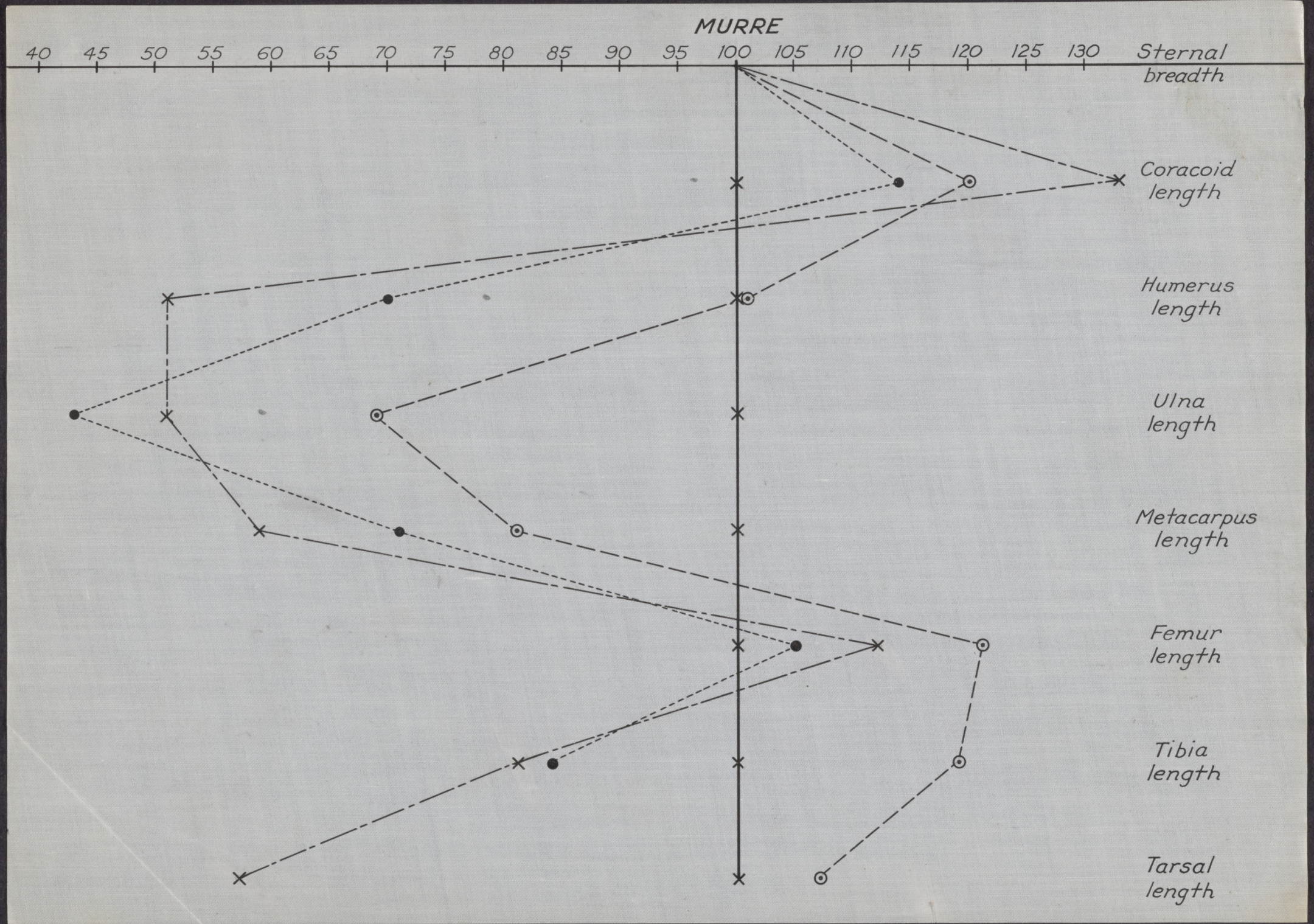
78.2

76.3



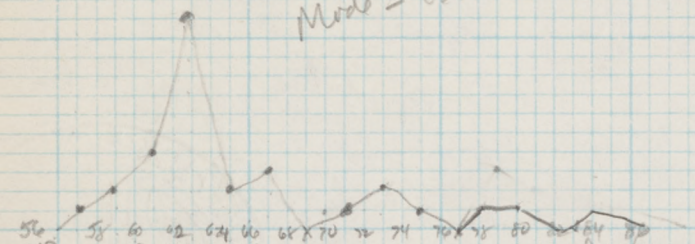
No. 6313, University Book Store, Los Angeles



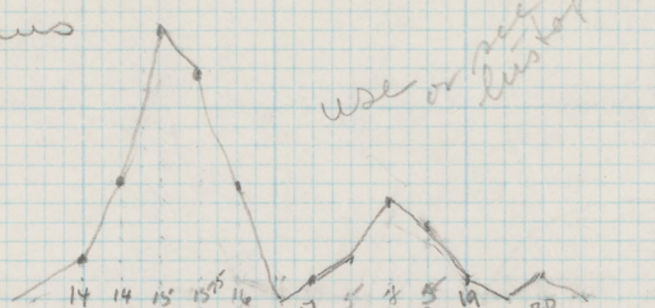

MURRE
40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125 130
Sternal breadth
Coracoid length
Humerus length
Ulna length
Metacarpus length
Femur length
Tibia length
Tarsal length

Median = 63.5
M = 65.89
Mode = 63.44

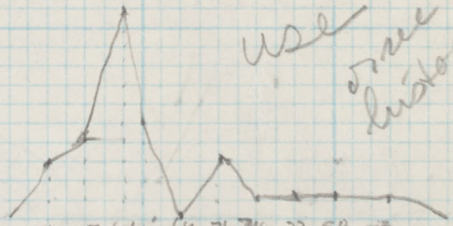
Humerus



use or proc. histogram

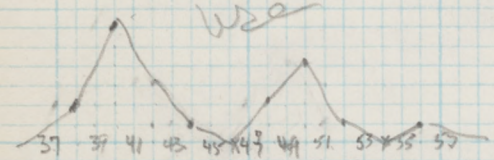


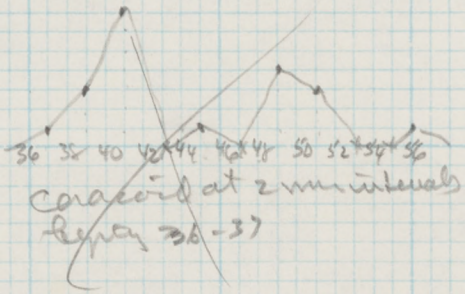
use
proc. histogram

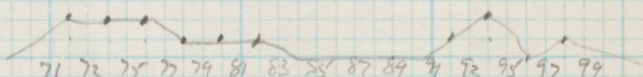


Coracoid

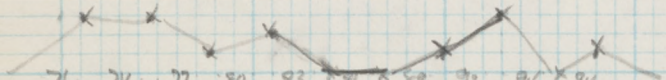
use

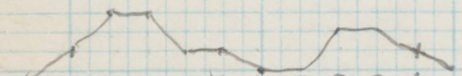


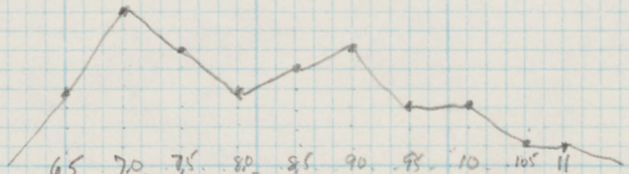


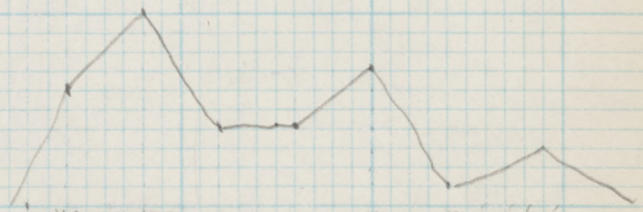


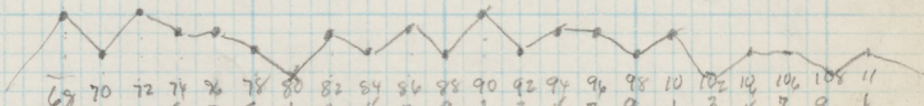
Tibiotarsus





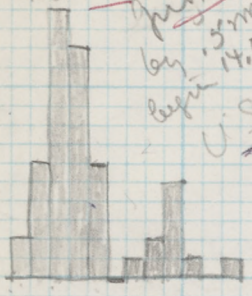






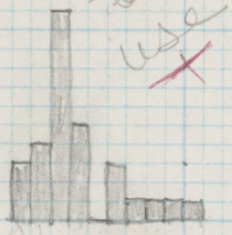
Humerus + coracoid + = use

humerus prox br. 3 mm intervals begin 14.0



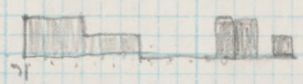
USE

humerus length 3 mm intervals begin 56



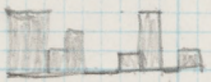
USE

tibia tarsus 2 mm intervals begin 71



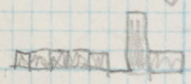
USE

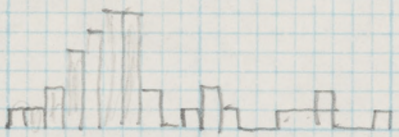
tibia 3 mm intervals begin 71



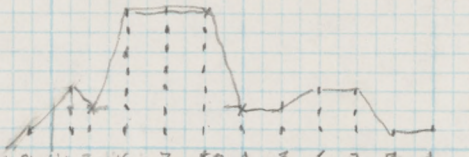
coracoid 1 mm intervals begin 39

carpus 1 mm int.

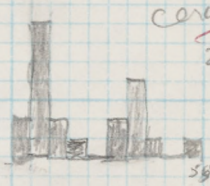




humerus length 3rd and deltoid 1 mm intervals



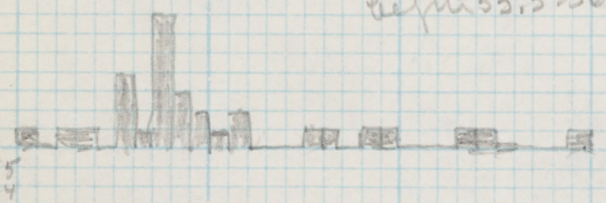
humerus dist ap begin 4.9

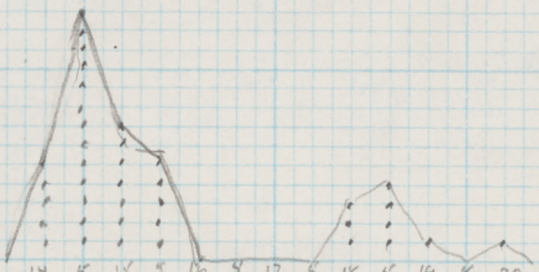


coracoid length 2 mm intervals begin 39.00

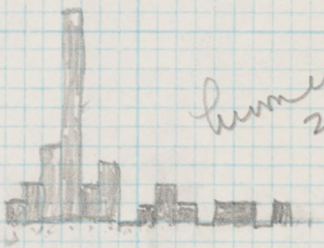
USE

humerus 1 mm intervals begin 55.5-56.1



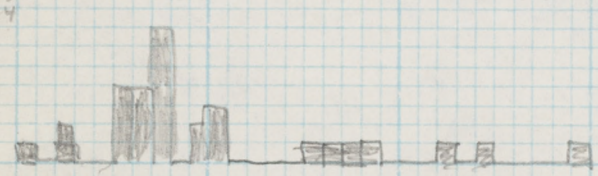


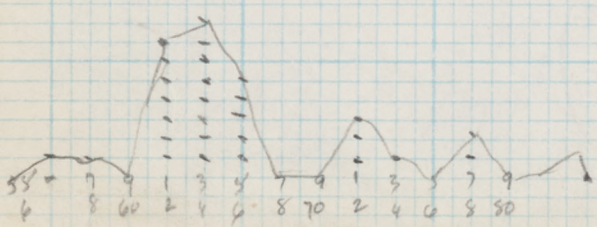
humerus prox begin 14-14.4

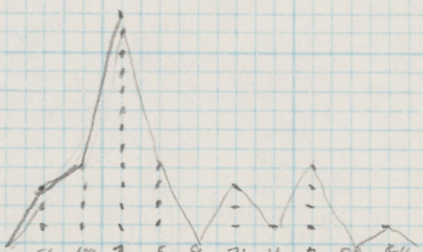


humerus 2 mm intervals begin 56

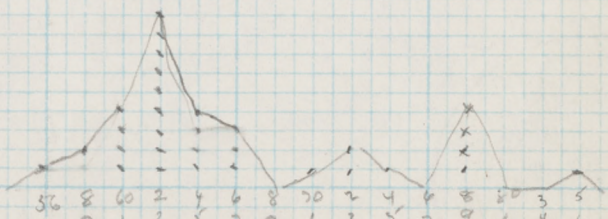
humerus 1 mm intervals begin 56-56.9







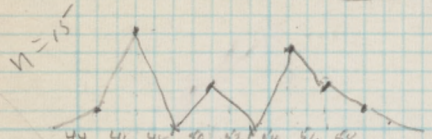
humerus length 3 mm begin 56-58



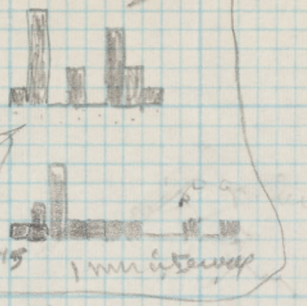
humerus 2 mm begin 56.57

Femur

n=15



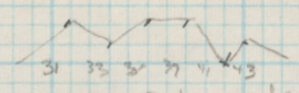
length femur manicalla
intervals, 2 mm begin
44-45
includes 25 lengths



1 mm intervals

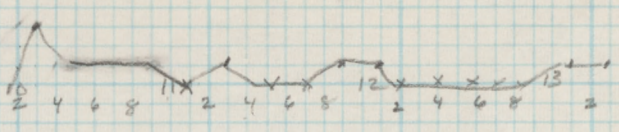
n=9

Parsumeba ceps

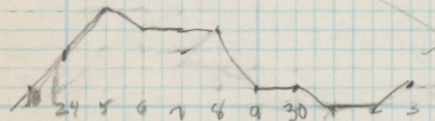


2 mm intervals
begin 31-32

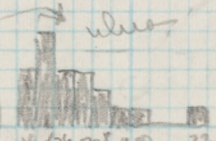
Scapula n=11



Ulna

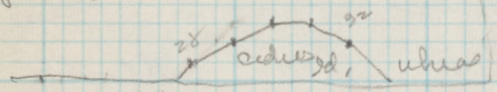


1 mm intervals - begin 24

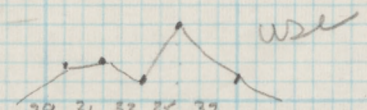


1 mm intervals

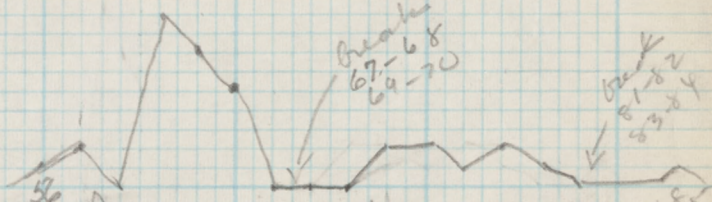
gr. length



Parsumeba capus
n=10

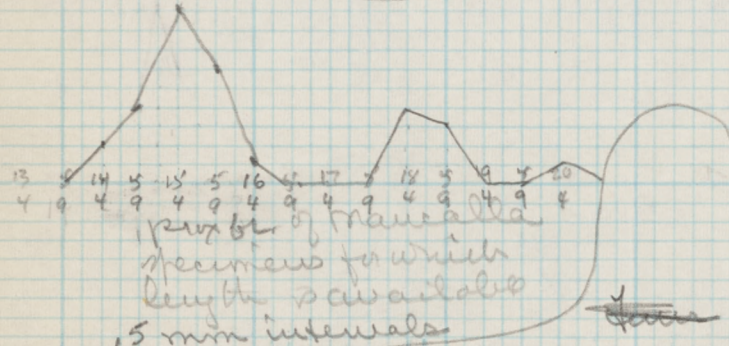


2 mm intervals
beg. 29-30

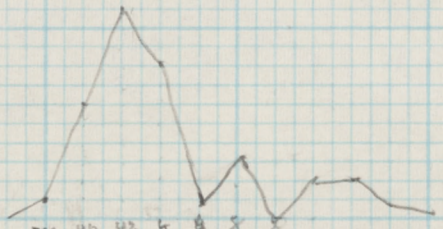


55-56, 57-58
59-60 etc

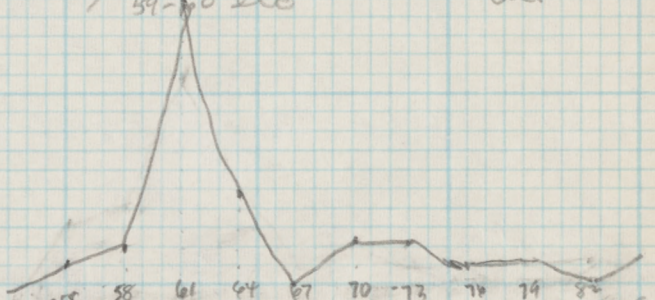
humerus length 2 mm
intervals



1 mm int. manicalla
specimens for which
length available
.5 mm intervals

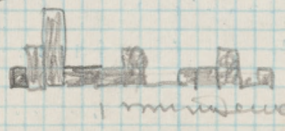


humerus length
to deltoid
2 mm interval



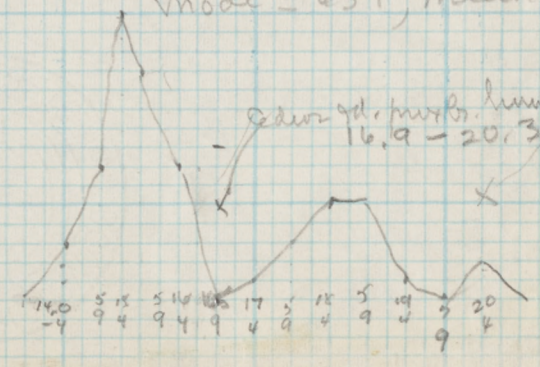
gr. length humerus
3 mm intervals

femur 2 mm intervals

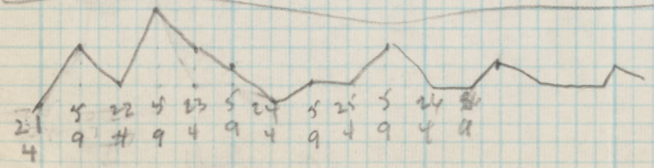


1 mm intervals

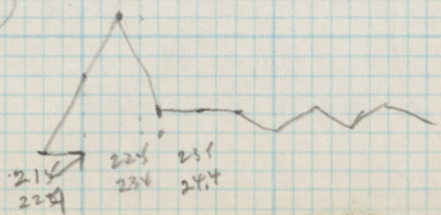
mode = 63.1, mean 65.9



radius gr. prox. humerus
16.9 - 20.3



.5 mm intervals ulna



1 mm int. ulna radius length

prox. humerus 62 bones .5 mm int.

Maxilla - LAM. (2)

2 Fauna {2091 / 2091} (3)

2072

(Miller - 2220 dist
-2220 sh
when 2218 D+ 10/29/47?)

phals ? (2) 2141
2161

Tibia (10) 2125 (large) -2270 dist tear
2083 -2281
2134 -2270
2108 -2270
2 {2071 / 2076 / 2100}
2085
2088
2089

Scapulae (4+1) unnumbered newborn -2270
2167 -2270
2086
2162 frag. (2)

Carpus (5+1) 3 {2060 / 2068 / 2060} -2281 (1)
2159
2092

Coracoid (4+1) 2087 -2270 (1)
2090
2104
2106

Fibula (1) 2094

Ulna (3+1) 2079
2069
2101

Hyphal (2) 2158
no #

Radius 2281 (1)

Carpal bone #? (1)

Humerus 2096 comp
2050 -2270 dist.
2084 -2281 new comp
2081 -2281 prox
2093 -2281 sh
2149 -2220 prox
2062 -2220 prox.
2135 -2220 prox
2065 -1367 prox
2066 -no # frag dist
2103 2218 comp
2077
2062
2159
3 {2066 / 2066 / 2060}
2146
2 {2065 / 2065}
2098 large

(2 ?)
2 1/1 +
Type cast
add 1 Mus (3) / Hum

Total all elements Miller 31

Miller (10)
2269 comp.
-2270 dist.
-2281 new comp
-2281 prox
-2281 sh
-2220 prox
-2220 prox.
-2220 prox
-1367 prox
-no # frag dist
2218 comp

Brach str articulars (3) 2107
2 {2074 / 2074}

Femur (6) 2 {2076 / 2076 } (1)
2063 -2220
2156
2 (Many) {2173 / 2173}

Radius (2) 2073
-2165 sac (3)
2139 sac. -2281
2170 sac. {2270a / 2270}
2153 frag.

Tibia (6) 2078 (5)
-2097 -2220 comp
-2137 -2218 dist
-2162 -2270 frag
-2 {2145 / 2145} -2270 dist
-2270 dist

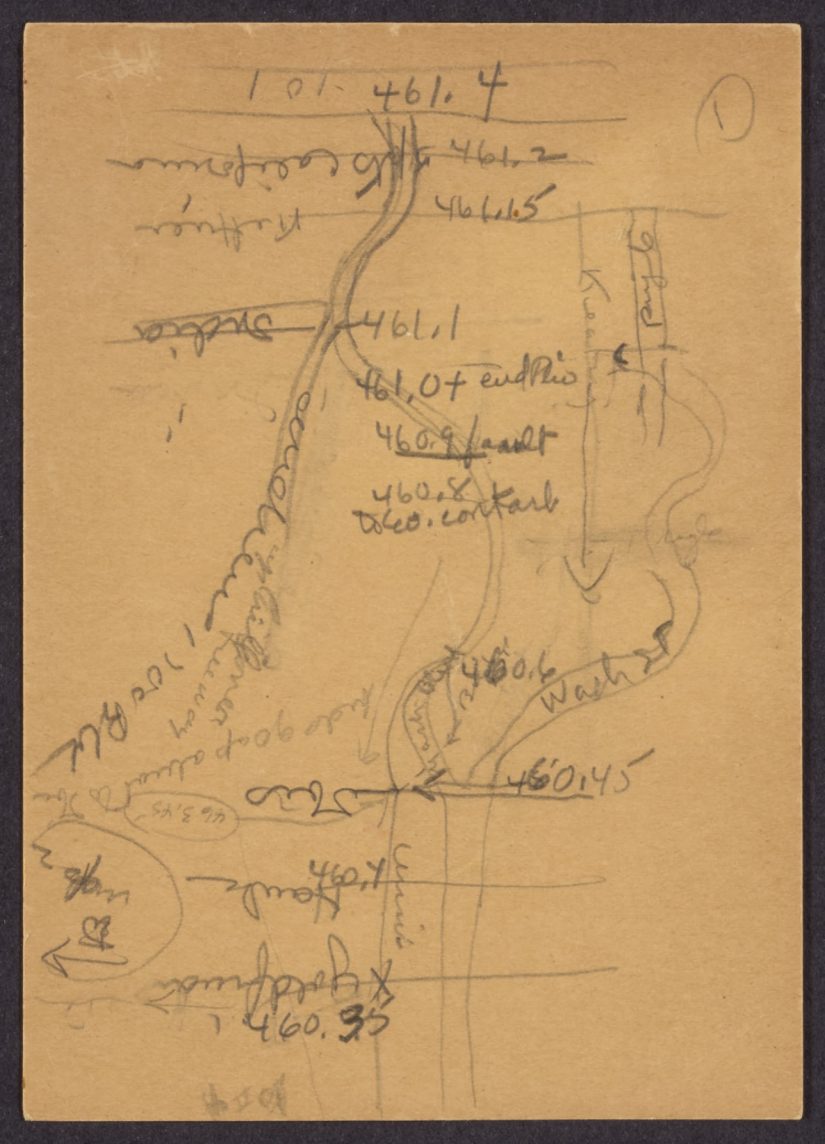
Vertebrae (8) 2045
2195
2155
2075
2157
2150
2095
2132

88 sacs
30 LAM
1 UC
4 Mandibles
1 Tibia

Lab. Tibs
83 here
7 not labeled
4 Mandibles
94 total

Material available

from the several San Diego sites


461.4
461.2
461.15
461.1
461.0 end Rio
460.9 fault
460.8
460.6
460.45
460.35

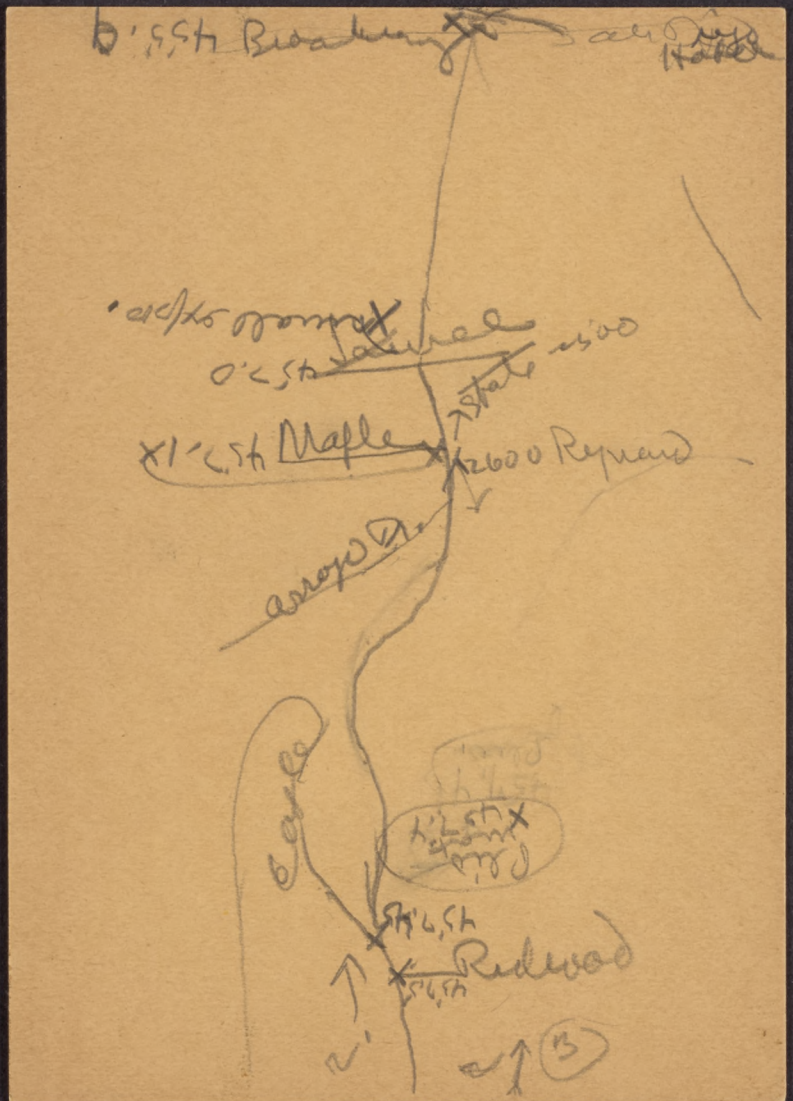
Pennsylvania

Rail Road Co.

Butler

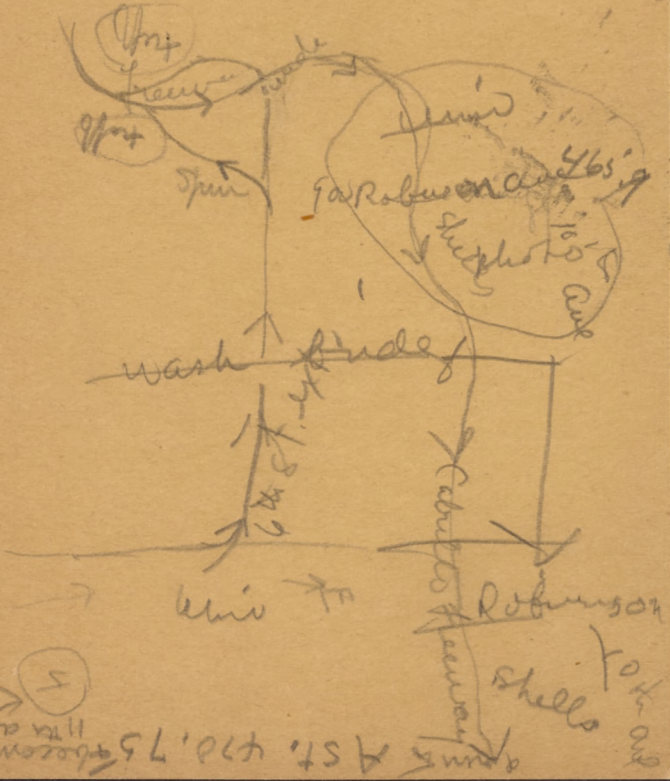
Bush

(2)


Maple
2600
Redwood
13

Y64.25'

Y67.3 Wash. 75th ave



Calif. Avian fossil localities – new records

Pliocene

San Diego – continue to get occasional specimens
Most outstanding unrecorded is a very large
64 sulid (gannet?) coracoid (tibia + humerus?)
Continue to add specimens of Mancalla

Pliocene
Corona del Mar – Newport Bay
10 Added Mancalla – 2 humerus (dist), coracoid,
3 carpometa, radius + ulna

Added Mancalla from both localities
suggests distinct spp. at Corona del Mar
from the 2 at San Diego.
Added grebe bones from San Diego indicate
that species is not C. parvus as 1st thought;

★ Pliocene –
3rd St tunnel
age being redetermined 64
Mr. Cline of Marine Div, Phillips
482.3131 ext. 313
phoned 4.2.65 Says area lies
on about midline between
Repetto (low. Plio) and
Delmontain (up. Mio.) + he will
take some bugs + analyze again
(after all these years).

Later telephoned back to say the Foraams indicate Repetto !!

SAN DIEGO PLIOCENE LOCALITIES

[Quien Vert + invert. loc. #'s later. Invert. locs just add 100 (ie 101, 102 etc. — Vert begin 1071 etc but ship certain #'s where no birds found See Bird Catalogue

1. East side of Curlew Street across the street from Ostego Drive. 2 brownish strata at 11 and at 16 feet above street level. Each 4 to 6 inches thick.

2. East side of Reynard Way between W. Redwood and Eagle street. Strata at eye level and slopes downward.

3. West side of Reynard Way between W. Redwood and Eagle streets. Strata 15 feet high and over, above street level.

4. West side of Reynard Way between Curlew street and Eagle street.

5. Exposure on corner east side Reynard Way and Torrance Street, below strat level. Mentioned in Mr. Miller's paper.

6. West side Reynard Way in back of house numbe 3030 Reynard Way. 8 to 10 feet above street level a shell stratum with bone stratum below.

7. End of Arroyo Drive. 25 to 50 feet above street level . Shell stratum of oyster and pecten above the bird bone layer.

8. Corner and Dove and West Palm Streets, empty lot with stratum 5 feet above street level.

9. East side Dove street, 3000 block, in back and on both sides of house numbered 3005. Bird bones below unconformity, about 10 feet above street level.

10. Exposure on Ostego Drive half way up hill from corner of Curlew Street. Stratum at street level.

11. Exposure in back of new houses 3500 block Curlew Street. 5 feet above street level.

12. Exposure between house 3021 Eagle Steet and 3065 Reynard Way.

13. Exposure at corner of Redwood and Falcon streets. 1 to 3 feet below street level

14

14. Corner of Laurel and State Streets, 2400 block on State street. Oyster bed between 1 and 3 feet thick begins at 32 feet and ends at 12 feet above street level. Bird material follows this just below

15. State street and Reynard Way. Sternberg locality number 8. Sweitzer Formation and San Diego Formation with unconformity between. (Sweitzer, the reddish sand in which shell gotten; San Diego the whiter sand adjacent -- birds from the latter)

16. Corner of Dove and Maple streets. Pecten and oyster beds 35 feet above street level -- all Sweitzer formation, no bird material (shells and some bones)

17. Maple street in back of houses across the street from locality 16. San Diego formation. Below street level and downwards.

18. Gully across street from locality number 5, 3500 block Reynard Way. Below street level.

19. Balboa Parkway project under construction. One bone. Stretch between University Ave. Bridge and Washington Street Bridge. Strata 40 feet below Washington Street level.

20. Canyon east of Balboa Park. Straight below San Diego Natural History Museum, half way down between Park and Florida streets.

21. South side of University Street between its junction with Washington street and Andrews Street. Strata with bird material begins from 1 to 65 feet above street level, about a half a mile long.

22. Pacific Beach. Shore slope below the end of Loring Street. (Eocene with Pliocene beginning at Loring and then Pleistocene on top) 20 to 30 feet above sea level, bluff. All Sweitzer, shells but no birds.

23. North side of Market street south of crossing with 34th street in the gully. Sweitzer Formation 20 feet below street level (no birds) Good sand dollars.

24. Exposure directly north of Snyder's Continuation School. Shell strata 15 feet below school floor level. No birds. San Diego Formation, however

25. Exposure 100 yards long, below north boundary of San Diego Zoo, 10 feet above street level.

26. East side exposure of Sixth Street Extension Project under construction. No bones. Too young an exposure, when weathered will be good.

27. Market Street continuation. ¼ mile south of Euclid road, Encanto, Calif. Shell strata 5 feet above street level. San Diego Form.

28. Midway Street behind and around U.S. Federal Frontier Housing Project. About 15 hillside cuts, 2 miles long. Sweitzer Formation, in some a little bit of San Diego. Shells and some bones, no bird.

Loye Miller Collection from San Diego

Loc. and number 2220: South wall 1/5 mile west of Washington and Hawk St. corner on 5-point Freeway. Squyres
seven bones: sternal fragment, complete femur, shaft tarsometatarsus distal end of tarsometatarsus and thre procimal ends of humeri

No. 2281: East side of Reynard Way-- Eagle and Redwood: Kennell.
eight bones: pelvis, radius, complete carpometacarpus, humerus proximal humerus, humeral shaft, shaft of tibiotarsus and complete ulna of Brachyramphus pliocenus (Cotype)

No. 2270: First Reynard Way locality: east side 500 yards south of Sutter: Kennell.
fifteen bones: 3 tibiotarsi (2 shafts and a distal end), 2 sacra, proximal end femur, coracoid, 2 distal ends femora, distal end large humerus, 2 scapulae. Proximal end humerus of Puffinus kanakoffi and proximal end of tarsometatarsus of P. kanakoffi, and a grebe tibiotarsal shaft.

No. 2218: same locality as 2270, material from Squyres
Shaft of femur, distal end humerus Brachyramphus pliocenus (cotype)
Shaft of tarsometatarsus Mosula?

No. 2269: Supposedly a complete humerus from here (recorded by Miller) but I haven't seen it as of 10/29/47.

No. 1367: Euclid and Market Sts.: Proximal humerus fragment and Type femur of Pliohunda diegense (later referred to Mancalla) Hence type of Mancalla diegense Miller. In Univ. Calif. coll.

No. 2281 continued: Distal end humerus (fragment); cormorant vert., distal end humerus P. kanakoffi and carpometacarpus P. kanakoffi.

Except as noted otherwise, all specimens belong to Mancalla, and were sutdied for Miller and Howard 1949 paper.

San Diego Pliocene ☆ = new species illus.

3 ☆	extinct small cormorant	P. Kanakoffi	—	coracoid & hum.	(2 vins)
9	" medium grebe	C. parvus	—	tibiotarsus	
2 ☆	" small grebe	Aechmophorus sp.	—	femur?	
9 ☆	" small shearwater	P. intermedius	—	humerus & tarsus	
8	" med. sized loon	G. concinna?	—	mandible & 2 IO	
2 ☆	" small murrelet	Brachyramphus pliocenus		humerus	
3	" Booby-cormorant?	Miocula-media?		Tibia	Tibia
90	" Mancalla	Mancalla californiensis — Miller		Miller	

1	beak			1 humerus Puffinus
1	~~beak~~ jaw			1 vert cormorant
5	sternum (frags)	+	1	1 hum. Brachyramphus
5	coracoid	+	1	1 carpus Puf?
1	furcula			
2	sacrum			
4	pelvis	+	1	
7	femur	+	3	
10	tibia	+	2	
3	tarsus	+	3	
21	humerus	+	5	
5	ulna			
1?	radius		1	
6	carpus	+	1	
3	phalanges			
	1 wing			
	2 foot			
1	carpal			
12	vertebrae			
90				

scap?

Newport

☆ Puffinus felthami

humerus & tarsus

W40

28

Tabula 102, 5

Lam. San Diego Muller S.D. U.C.S.D. Newport Type

Maucalla	87 (+2 phals. ok)	30	1	4 1
col. parvus	12	1		
Opehe sp.	2	—		
Jan. concinna?	9			
Ph. Kennedii ☆	3	1		
P. kanakoffi ☆	9	4		
Mitrula recentior ☆	3	1? (sm tapes)		
B. pliceus ☆	4	2		
Thorsbird?	1	—		
	130 (+2=132)	39	1	

43 | 8 0 9

Oct. 31, 1947.

(71)

Total all S.D.

Lam	130
LHM	39
UC	1
	170

Total Maucalla

S.D	118 (7 phals. added = 120)
Newport	4
Vacant	1
	123 (" " " = 125)

Check just no. & make total # Maucallidae 116
alcidae 8.

Columbus parvus 12 + 1
3 vertebrae
2 complete tibiotarsi
1 sh femur
1 prox tarsus
1 " carpus

H² 90/1325.

1 prox tibia
1 weak comp humerus
2 prox humeri

Gallus sp. 2
1 dist end femur
1 prox tib

Zamia concinna 9
5 frag. humeri
(1?) 2 wp } maxil. frags
1 coron }
1 frag cranium

Phal. kennedi 3 + 1
1 frag furcula
1 prox hum
1 frag cor (TYPE

Brach. pliocenus 4 + 2
1 humerus (TYPE)
1 frag hum.
1 ramus coron maxil.
1 cran.

Rhachitrichid ? 1
1 dist tarsus

San Diego Pliocene
Miller
1 sh. tibia ✓

Preservation?
~~Camp. agg.~~ S.D. T Cd M (1067)

Miller
1 vert
~~1 sh tarsus?~~
~~1 sh tib? ? ? Gal~~

1 dist humerus ✓
1 comp. ulna ✓

43 NOT Manzanilla
Mus.

Pulp. kaudhoffi

9 + 4

3 nearly comp humeri
2 frags. "
2 comp. femora
~~1 prox " 1 Mills~~
1 dist femur
1 prox tibia

Miller

1 dist fragmentary humerus ✓
1 prox carpus ✓
1 prox shaft fragmentary humerus ✓
1 prox tarsus ✓

Miocuela? 3

1 nearly comp tibia
1 prox ulna
1 dist sh humerus

Miller & non-mammalia

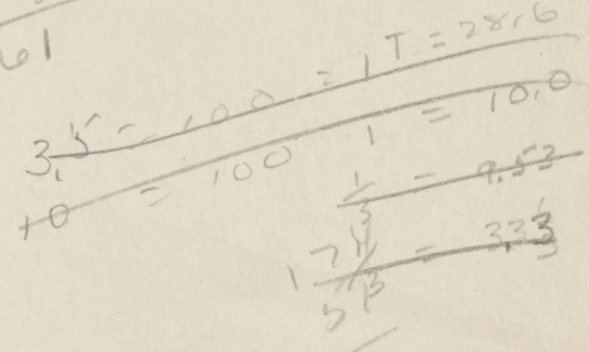
Phlebinda 2

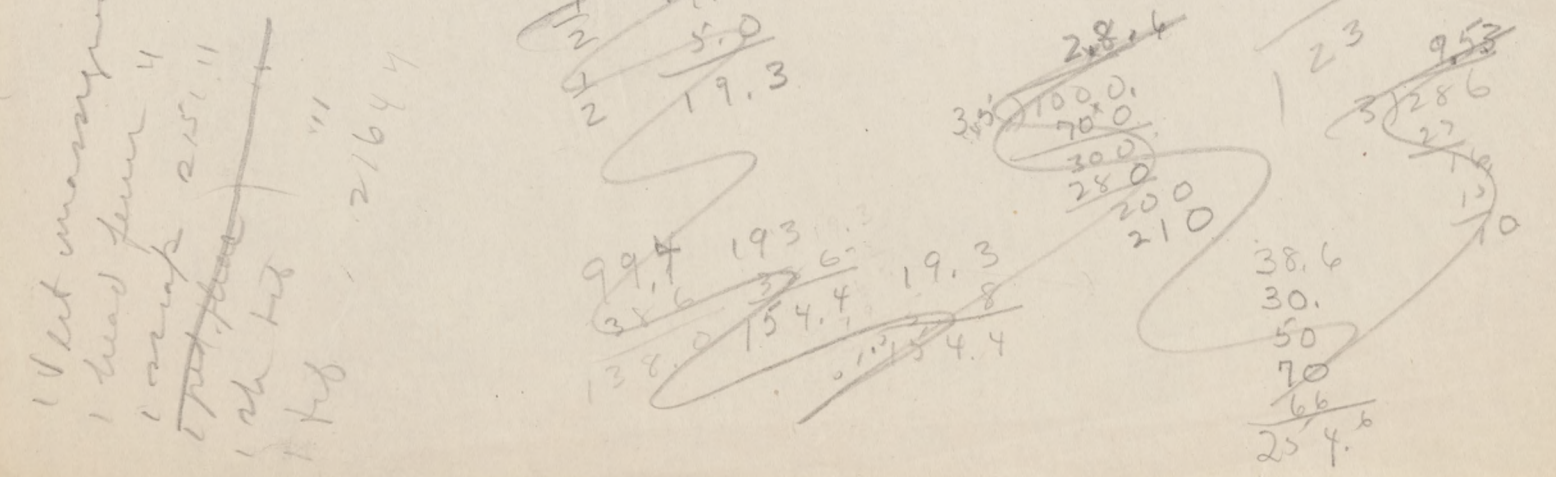
~~1 prox hu~~
1 femur type Miller
1 " Miller

Mammalia miller. 32
LAM.

5'3 non Maur. LAM
Miller

8 "
61





Report on San Diego beds by René Engel

October 22, 1947

Dr. Hildegarde Howard:

"After studying the San Diego sediments associated with the bird horizon, the most important facts which are revealed are as follows:

"Three ~~layers~~ beds of sands and gravels were considered; the lower layer, consisting of a fine grained white-gray silty sand, ~~the~~ a middle brown sand, medium to coarse ~~sand~~, corresponding to the bird horizon, and a top medium coarse rusty sand which frequently merges into the middle sand.

The top 5 middle layers together attain a depth of 10". The lower beds are of greater thickness.

Brown 6" [illegible]

"Material from localities L.A.M. 101, 102 and 121 were examined. As a whole, the individual characters of the three beds ~~layers~~ are very similar at these three localities.

"The lower sand is very well ~~salted~~ sorted, composed mostly of quartz and biotite, ~~mostly~~ almost unaltered. At the interface between this sand and the brown middle layer, flat granules ~~pebbles~~ varying in size from two to nine mm. and composed mostly of meta-quartzite fragments are found here and there, and their number increases in the brown silty sand layer, ~~The~~ but the average granule size is smaller.

The middle sand is not as well ~~salted~~ sorted as the lower sand, and is coarser. It is made up mostly of quartz ~~&~~ grains stained with limonite, biotite, hornblende and some feldspar. The brown color of this sand is due to its high content in ~~limelite~~ limonite derived ~~from the oxiation~~ by alteration and oxidation of the femic ~~materials~~ minerals. At Locality 121, fragments of marine shells mixed with the sand are abundant. Lateral variation in grain size, along the bed, from medium ~~sand~~ grained soft sandstone to medium granule and small pebble conglomerate was observed at that locality on a distance of about one thousand feet. The composition of the upper sand is nearly the same as that of the middle one. The degree of ~~salting~~ sorting is about the same. However, granules and conglomeratic elements are missing. Although the degree of alteration of the femic minerals is less than in the brown sand, and the development of limonite ~~is~~ less intense, the general oxidation of that sand is greater than that of the lower sand. Merging of the middle and upper sands indicates cross-bedding and channeling. Moreover, the composition and degree of oxidation links closely these two horizons together.

In conclusion, the characteristics of these sediments point toward different origins; the lower sand was deposited

under sub-aqueous conditions; the middle brown sand and the upper buff rusty sand were laid under sub-aerial conditions, probably in tidal flats and lagoons situated on the margin of a land mass situated to the west of the area where these sediments are found today. The material forming these two ~~upper continental~~ sand layers indicates re-worked sediments derived from ~~xxxxxx~~ older sediments forming a western land mass, which formerly occupied the area of the present San Diego bay."

Dr. Engel's interpretation adequately accounts for the presence of large numbers of the flightless Mancalla. These tidal flats may ~~easily~~ well have afforded protection from marauding predators by reason of marshy or boggy areas between them and the main land mass.

Judging from the occurrence of the dark sands (brown to yellow) at more than one level, with the gray sands between, the area must have undergone periods of slight emergence, followed again by submergence into a shallow bay. Possibly the Point Loma area represents a remaining spur of a land mass which once formed the westerly border of this bay.

Rene Engle concerning samples from San Diego Pliocene

1. Chocolate sand: "This silty sand made up of subangular to angular grains of quartz, with some feldspar, altered flakes of biotite, some sericite and a good deal of limonite derived by alteration of some ferric minerals (biotite included), shows xxxxxxxxxx hardly any sub-aqueous transportation and sorting -- as far as it may be inferred from a hand specimen. The brown patches of sand are mixed with the buff-gray silt and the coarser arkosic yellow buff sand (on top of specimen -- or bottom?). The whole mass is permeated with alveoles, flattish cavities and pores, which could not have subsisted if there had been much compaction thru successive stratifications, in a large body of water. These pores are very likely due in major part to organic causes and in part to alteration and solution effects.

"Thus it seems that this type of rock would correspond to a shore line deposit (there are some shell casts), above low tide and thus in part aeolian and in part aqueous, as found in mud flats."

2. Gray sand in which Kanakoff found fragmentary skull, jaws and vertebrae of loon all together: "This sand is more uniform than (1) -- finer grained, more rounded and could be a beach sand -- the mixture of mica with quartz shows no sorting effect, as would be observed (on the contrary) in sands laid under water by slowly moving currents. However, here again, more information should be gleaned in the field, concerning the occurrence and relationships of these rocks."

1949
Miller & Howard 232 bones Mancalla
including cast of type humerus & 4 bones from Loc 1047 carpus, met. & tarsi
124 from San Diego (35 Miller coll., 90 Stem) + type Pliolimnatornis chapmani

Monographed material from San Diego Pliocene

MANCALLA (90)

	Bone No.	Loc.No.	Description	Bone
S	2062	1072	Left distal HUMERUS	HUMERUS (24
S	2062	1073	" " "	"
	2065 frag	1076?	" prox.frag"	"
	2065 frag	1076	" dist. " "	"
	2066	1071	Right prox. (size?)	"
	2066	1071	" " frag	"
S	2066 meas	1071	" prox.(and dist.)?	"
S	2066 (fragfrag	1071	" prox.	"
S	2077 meas	1071	Right prox ½	"
S	2080 meas	1074 nearly	right nearly complete	"
S	2081 not meas	1080	left " " Proximal	"
S	2084 meas	1080	right " "	"
	2093 frag	1080	left shaft	"
S	2096 meas pub	1080	left complete	"
S	2096	1080	" "	"
	2098 meas pub	1080	left comp. in many pcs.	"
	2103 frag	1080	right prox. frag	"
S	2135 meas	1080 incomple	left incomplete	"
	2146 frag	1080	left prox. frag.	"
	2149 frag	1080	frag. sh.(R?L?)	"
	2159 frag	1075	right prox. frag.	"
S	2183 meas	1071	right dist.	"
S	2183	1071	" "	"
	2060		proximal right	CARPOMETACARPUS 6
	2060 meas pub		nearly complete R	"
	2068 meas pub.		complete right	"
	2068 meas pub.		proximal left	"
	2092	center section	left	"
	2159		frag. sh (L?)	"
	2158 meas pub for one		2 wing phalanges	WING PHALANGES
L	2064 meas pub.		right incomplete, large	ULNA 6
	2069 meas		left incomplete	"
S	2079 meas pub.		left incomplete	"
S	2082 meas pub.		right complete	"
	2101 meas		right incomplete	"
S	2179 meas pub	1071	left complete	"
L	2067 meas pub		right complete	CORACOID 6
L	2087 " "		left complete	"
S	2090		left incomplete	"
S	2104		left dorsal end	"
S	2106		right incomplete	"
L	2184		right incomplete	"
	2049		right half	SCAPULA 5
	2070 meas pub		left nearly complete	"
	2086		right fragment	"
	2167		right incomplete (2pcs)	"
	2176 meas pub		right nearly complete	"

2182 nearly complete PELVIS

14 Padre, 1 type M. calif.
Turnicula, Padre
Also Miller
2218. hum S meas pub
2220. meas pub
2270 meas pub
(S hum) 2258 meas pub
2216 (hum S)
2269. hum S (meas pub.
1 Padre 2258 meas pub
2270 meas pub 1 radius Padre
only 4 reported in monograph
1 ulna Padre
2 Padre
2 coel (meas pub for 2270 2 specimens)

2077		left complete	FEMUR 9	
2078		left distal (large	"	
2145		left distal inc.	"	
2145		right incomplete	"	
2162		right nearly comp.2pcs	"	
2137		left distal	"	
2185	1071	left complete	"	
2186	1071	left prox.	"	
2186	1071	" "	"	
2071		left distal	TIBIOTARSUS 11	
2071		right distal	"	
2088		prox.& dist.½'s R	"	
2085		right incomplete (3pcs.)	"	
2083		right complete (2pcs)	"	
2134		left nearly complete	"	
2177		right complete	"	
2090		right distal	"	
2108		left incomplete(dist.)	"	
2100		distal right	"	
2125		nearly comp. R large	"	
2072		right frag. dist	TARSOMETATARSUS 5	
2091		right distal	"	
2091		right incomplete (yg.)	"	
2177	1071	right complete (small)	"	
2178	1071	left complete large	"	
2063		nearly complete	STERNUM 7	
2076		2 fragments post.R	"	
2156		frag. costal R	"	
2173		frag.costal R	"	
2173		3 more frags.	"	
2080		nearly complete	"	
2181		3 frags. (1 ant.end)	"	
2139		half a sacrum	SACRUM	
2165		complete	"	
2073		right acetabulum	PELVIS 3	
2153		frag.	"	
2170		left post.half acetab.	"	
2182		nearly complete	"	
2074		left articular	JAW	
2074		rt articular		
2107		fragment	UP. MANDIBLE	

Recorded specimens Howard 1949 San Diego Pliocene

Columbus parvus [not of this sp. as later described]
- tibiotarsi 2174 and 2113
- prox tarsus. 2130
- prox carpo. 2136
- 3 frags. humeri 2131 - 32
- 3 verts 2075 and 2138
- femur sh 2148
- prox tibia 2143

Grebe sp. + tibiotarsus 2129, femur 2118

Gavia concerina? mandible 2110 + 2109 (with cranium
humerus 2133 + frags. humeri 2111, 2175, 2142, 2144
↑ assigned later to Gavia howardae Brodkorb

Puffinus bannerbyi + type 2122 + tarsometa. Loc 1080
humerus 2120, femur 2124
Loc 1078 Loc 1080
Tarsus 2124, 4 humeri 2114, 2116, 2146, 2160 Miller
+ tibiotarsus 2123 [+ 2 in Miller coll. (2270)]

Phalacrocorax bennelli TYPE coracoid 2127 Loc 1080
prox humerus 2121, furcula frag 2115
Thanet vert. (Miller coll.)

Morcula recentior + TYPE Tibiotarsus 2117 Loc. 1071
Prox ulna 2112 Loc 1071

Brachyramphus pliocenus TYPE humerus 2119 Loc. 1080
dist humerus (Miller 2218) + ulna (Miller 2251)

Shorebird + tarsometatarsus 2128

Mancalla - 90 bones LACM - 28 Miller coll. described 1949

Recorded 1958 By Walter Berman

Grebe femur 2118 + tibia 2129 + femur 2545 + type
+ coracoid 2354 referred described as Colymbus subparvus
and lists smaller femur 2605 as of a different (undescribed) sp.

Recorded - Brodkorb date —

Gavia howardae - humerus 2133 (listed above as G. concerina?)
refers to humerus 2175 " " " " "
type → humerus - 2111 Type of G. howardae

Dear Hildie -

Mancalla bones were taken as follows:-

#2218, #2269, #2270 } First Reynard Way locality. East side, 500 yds. south of Cor. Sutter St.

Material from both Squyres and Connell.

#2281 - From Connell's new site on Reynard Way, East side bet. Eagle + Redwood.

#2220 - From Five Points Freeway South wall 1/2 mile west of Washington + Hawk St. corner.

Material from Squyres.

See p 32. Condor 48: 32-46 Jan. 1946.

Love to You

Padre

Sept 8/47

1367 Euclid ave Market

Dr. Hildegarde Howard
Los Angeles Museum
Exposition Park
City

Miller Mancalla - monographed 35

humerus
12 ✓2220 3 prox. — 2270 dist. XXX 2294 (3)
✓2281 complete ✗ 2269 comp. (in lit. but haemstreet) ✗ 2281 dist (# for?)
✓ " prox ✗ 1367 prox
✓ " shaft

femur
5 ✓2220 complete ✗ 2218 shaft
— 2270 prox
= 2270 dist (2)
~~2270 prox~~
~~3 67~~ type Phoberia

2 tarsus
✓2220 shaft
✓ " distals

1 sternum pats
✓ 2220 frag

3 pelvis pats
✓ 2281
= 2270 (2) sacrum

Radius
1 ✓ 2281 comp.

1 carpometa
✓ 2281 comp.

6 Tibiotars
✓ 2281 shaft
— 2270 dist
= " sh (2)
XX 2294 (2)

2 ~~2~~ coracoid
— 2270
X 2294 (1)

2 scapula
= 2270 (2).

myology
2270 and 2218 from Reynard Way, probably Locality 75

femur
2281 Reynard Way = Locality 52
1367 Market & Euclid humerus (prox)
2220 Wash Blvd freeway femur & humeri Locality 1080

35

90
13
103

	L.A. Museum monographed	new	total	MILLER monographed	new	total	TOTAL
Humeri	29	69	~~98~~ 98	12			
furcula	1	—	1				
femur	9	10	~~21~~	5			
Tarsometa	5	14	21	2			
Vert.	13			—			
Fibiotars	12	28	40	6			
Pelves part	2	1	~~3~~ 3	3			
Skull	3			—			
Coracoid	7	25	~~34~~ 32	2			
Scapula	5	10	~~17~~ 15	2			
Sternum part	8	5	~~14~~ 13	1			
skull-Tjaw	1	10	11	—			
ulna	5	21	26	—			
Radius	6	6	6	1			
phalanx	1	—	1	—			
Carpometa	6	10	~~18~~ 17	1			
		209		~~39~~			

4 cor. del Mar

Coronadel Mar Reef	1		
ulna	—	1	1
rad	—	1	1
carpo	1	3	4
tibia	—	1	1
humer	—	2	2
coracoid	—	1	1
tarso	2	1	3
	3	9	

(over) Los Millers Stream

The avian ~~xxxxxxxxx~~ localities worked by the Museum include the following:

East side of Curlew Street across the street from the end of Ostego Drive. L.A.M. loc. 101 1071 (32 bird skins)

Exposures on both ~~and~~ t and west sides of of Reynard Way from Curlew street (south) to Torrance street (north). A distance of about .6 of a mile. For the sake of convenience the indivual spots where birds were taken have been given separate Locality numbers, as follows:

Miller 2281

Reynard way between Redwood and Eagle (east side of Reynard Way loc. ~~102~~; west side 103. (1073)

Reynard Way between Curlew street and Eagle (west side of Reynard Way ~~loc. 104~~ ~~in a gully, loc. 118; west side~~ 1074

2218 ? 2270

Reynard Way at Torrance street (east side Reynard Way, loc. 105; the same as Loye Miller's locality 2218? Squyres; west side Reynard Way -- 3500 block ~~00~~ in gully, loc. 118. 1077

Reynard Way north of Redwood back of house 3030, loc. 106 1076

Exposure on the Balboa Parkway project 40 feet below Washington street level between University Ave. bridge ant Washington St. bridge. LA.M. loc. 119. 1078

Canyon east of Balboa Park below Natural History Museum, betw between Park and Florida streets. L.A.M. loc. 120 1079

South side of University Ave. below its junction with Washingtn street. Exposure running along highway for about .2 of a mile. Bird stratum at one foot level ~~at~~ the junction, rising to a height of 65 feet to the southwest. L.A.M. loc. 121, and Miller loc. 2270 (Condor, 1946, vol. 48, p. 32) 1367 1080

In addition to these sites, Miller has reported bird specimens from an exposure on Market street near Euclid. This makes a total of six distinct localities in San Diego, or if we choose to break down the Reynard Way sites by blocks, ~~xxxxx~~ (exposures occurring in four different blocks) the number is increased to nine, an addition of six to those previously recorded.

1071 - 32 specimens
1072 + 1073 east & west sides of Reynard Way between Redwood & Eagle - 22 specimens
1074 - 1 specimen
1075 and 1077 east & west sides of Reynard Way at Torrance - 24 specimens
1076 - Reynard Way north of Redwood back of house, 2 specimens
1078 - Balboa Parkway project - 2 specimens
1079 - Canyon east of Balboa Park - 2 specimens
1080 - So. side Washington Blvd freeway - 3 specimens
Miller 1367 Market & Euclid - 2 specimens

Conclusions

for Dr Howard.

Mancalla Ulnae

SPECIES	SPEC. NO.	LOC. NO.
diegense	2064	1073 diegense
"	2231	1080
"	2234	1071 diegense
"	2509	1075 diegense
milleri	2257	1075 milleri
"	2258	1075
"	2294	1080
"	2306	1080
"	2342	1074 milleri
"	2484	1080
"	2485	1080
"	2552	1071 milleri
"	2558 (2 specimens)	1071 milleri
"	2638	1080
"	2690	1073 milleri
"	6926	1075 milleri
	2439	1080 milleri

Mancalla Ulnae

species	spec. No.	Loc. No.
diegense	2064	1073
"	2231	1080
"	2234	1071
"	2509	1075
milleri	2257	1075
"	2258	1075
"	2294	1080
"	2306	1080
"	2342	1074
"	2484	1080
"	2485	1080
"	2552	1071
"	2558 (2 specimens)	1071
"	2638	1080
"	2690	1073
"	6926	1075

Unmonographed material from the
San Diego Pliocene
1948, and Dec., 1947

COLYMBUS PARVUS (13)

Bone No.	Loc.No.	Description	Collector	Date
2220	1075	nearly comp. right tibiotarsus	Kennell	4.22.48
2188	1071	prox.&dist.right tibiotarsus (1 indiv.?)	"	12.22.47
2187	1071	complete left tarsometa.	"	"
2239	1080	¾ left tarsometatarsus	Kanakoff	5.12.48
2239	1080	left prox. "	"	"
2189	1071	complete right femur	Kennell	12.22.48 Miller & Bowman 1958 p.5
2203	1071	distal left femur	"	" —— ditto
2191	1079	prox. left tarsometa.	"	12.3.47
2218	1075	left ulna (young?)	"	4.1.48
2190	1071	distal right tarsometa.	"	12.22.48
2241	1080	prox. left ulna	Kanakoff	5.12.48
2225	1080	distal left humerus	"	"
2247	1079	comp. carpometa right	Kennell	5.20.48
PUFFINUS KANAKOFFI (2)				
2240 A	1080?	left proximal half humerus	Kennell	5.12.48
2240	1080	left prox. end humerus	Kanakoff	5.12.48
MISCELLANEOUS				
2217	1075	distal frag. humerus	Kennell	4.1.48
2214	1075	rib end	"	"
2211	1075	frag. furcula?	"	"
2222	1072	shaft left tibia (Mancalla?)	Kennell	3.24.48
2222	1072	frag. (Of what?)	Kennell	"
2196	1071	inc. sh carpometacarpus	"	12.22.47
2197	1071	2 vertebrae	"	"
2194	1071	pedal phalanx ~~(grebe?)~~	"	"
2198	1071	vertebra	"	"
2201	1071	frag. sacrum	"	"
2202	1071	prox. frag. hum. right	"	"
2199	1071	atlas	"	"
2193	1071	pedal phalanx (grebe?)	"	"
2200	1071	frag. axis	"	"
2195	1071	symphysis furcula	"	"
PHALACROCORAX				
2192	1071	dist. frag. tarsometa.	"	"

2204-2210
2213-
2215
2219
2221
2223-2224
2226-2233
2242-2245
2247-48

Unmonographed material from the San Diego Pliocene 1948 (and 2 from Dec. 1947)

These ~~crossed out~~ were used in 1950 monograph by Ttl on Mancalla though not necessarily listed by number herein.

MANCALLA (35)

Humeri:

Bone no.	loc. no.	description	collector	date
~~2219~~ meas'd	1075	complete right (left?)	Kennell	4/22/48
~~2207~~ meas'd	1075	incomp.(prox.)R large	"	4/1/48
~~2206~~ meas'd	1075	nearly comp. R	"	"
~~2206~~	1075	proximal Right	"	"
~~2206~~ meas	1075	proximal Left	"	"
~~2206~~	1075 but S	Incomp(dist.) R Not meas.	"	"
~~2230~~ meas'd	1080	shaft and part of prox. R(large?)	Kanakoff	May 12.1948
~~2231~~ meas'd	1080	distal half R	"	"
~~2228~~	1080	incomp.dist.half (large) (L probably)	"	"

CORACOIDS

2242	1081	incomplete R (large)	Kennekk	3/24/48
2229	1080	complete right	Kanakoff	5/12/48
2243 Mt	1074	complete right	Kennell	3/24/48
2208	1075	complete left(small)	Kennell	4/1/48
2208 Mt	1075	nearly comp.L(small)	"	"

CARPOMETACARPUS

~~2223~~	1080	proximal left	Kanakoff	5/12/48
2245	1075	proximal right	Kennell	4/22/48
~~2213~~ Mt	1075	Incomplete left	Kennell	4/1/48

RADIUS

~~2238~~	1080	proximal (?)	Kanakoff	5/12/48

TARSOMETATARSUS

~~2232~~	1080	proximal left	Kanakoff	"
~~2224~~	1080	dist. ¾ right	"	"
~~2224~~	1080	dist ½ left(frag.)	"	"

TIBIOTARSUS

2233	1080	proximal frag. R	Kanakoff	5/12/48
2226	1080	shaft left	"	"
2226	1080	" "	"	"
~~2209~~	1075	complete right(2pcs)	Kennell	"
~~2210~~	1075	distal left	"	"

FEMORA

~~2244~~ meas	1074	distal left	Kennell	3/24/48
2227 meas	1080	shaft left	Kanakoff	5/12/48
2221 meas	1075	distal left	Kennell	4/1/48

SKULLS

~~2205~~	1071	Cranium and rostrum	Kennell	12/26/47
2204	1075	cranium only	"	12/22/47

MISCELLANEOUS

2215	1080	Pedal phalanx	Kanakoff	5/12/48
2210	1075	vertebra	Kennell	4/1/48
2247	1079	pedal phalanx	"	5.20.48
2248	1079	proximal right ULNA	"	"

Unmonographed material from the
San Diego Pliocene
June 1949

Bone No.	Loc. No.	Description	Collector	Date
	COLYMBUS PARVUS (8)			
2266	1075 B	left tarsometa. nearly complete	Kanakoff	6.16.49
2267	1075 B	right tarsometa. nearly comp. (larger)	"	"
2291	1080	troch & sh. tarsometa. frag.	"	6.17.49
2265	1075 B	nearly comp. tibia L	"	6.16.49
2270	1075B	prox.& sh. left tibia	"	"
2268	1075 B	ant. frag. sternum	"	"
2284	1080	prox.right tibia,frag.	"	6.18.49
2298	1075 A	left fibula	"	6.17.48
	PHALACROCORAX			
2299	1075	shaft left tarsometa.	"	6.16.49
	MISCELLANEOUS			
2279	1080	large vertebra	"	6.17.49
2279	1080	large vertebra	"	"
2264	1075	large vert.	"	6.16.49
2261	1075	small vert	"	6.16.49
2285	1080	" "	"	6.18.49
2300	1080	frag. pelvis, sp.?	"	6.17.49
2255	1075	sh. and part dist. tibia (tiny)	"	6.16.49
2255	1075	sh. tibia (tiny	"	6.16.49
2253	1075	pedal phalanx (Mancalla?)	"	6.16.49
2295	1080	" " (grebe?)	"	6.17.49
2262	1075	3 shaft fragments	"	6.16.49
2272	1075 A	1 shaft frag.	"	6.17.49
	LARGE GULL*LIKE BIRD			
2263	1075 B	cranium	"	6.16.49

(Miller examined but did not record; left note on his findings (see yellow sheet)

Unmonographed material from the
San Diego Pliocene
June, 1949

Later 1970 monograph used most of these particularly those crossed out.

MANCALLA (29) -1 (see 2282)

Bone no.	loc. no.	Description	collector	date
Humeri				
~~2289~~	1080	prox.&dist.L (separate) meas	Kanakoff	6.17.49
~~2296~~ meas	1080	distal Right(large)	"	6.18.49
~~2280~~ meas	1080	prox. ¾ right	"	6.17.49
~~2292~~ meas	1080	complete left	"	6.17.49
~~2251~~ not meas	1075	dist. half left	"	6.16.49
2256	1075	frg. dist. left	"	6.16.49
Ulnae				
~~2257~~ meas	1075	complete right	"	6.16.49
~~2294~~ meas	1080	dist. ¾ right	"	6.17.49
~~2287~~ meas	1080	nearly comp. right	"	6.18.49
~~2258~~ meas	1075	distal right	"	6.16.49
Coracoids				
2282	1080	upper left out	"	6.16.49
~~2276~~	1071	nearly comp. left	"	6.16.49
~~2290~~	1080	nearly comp. right	"	6.17/49
~~2269~~	1075 B	upper ¾ right	"	6.16.49
Radius				
~~2274~~	1075	radius in 2 pcs.(inc.)	"	6.17.49
Carpometacarpi				
2277	1071	shafts both metacarps. R	"	6.16.49
2288	1080	prox.& dist. frags. L	"	6.18.49
Scapulae				
~~2278~~	1071	left (½)	"	6.16.49
~~2297~~	1080	left ¾	"	6.18.49
~~2252~~	1075	left (¼)	"	6.16.49
Tibiotarsi				
~~2283~~	1080	nearly comp. R.(prox.)	"	6.18.49
~~2286~~	1080	" " R (dist.)	"	6.18.49
~~2259~~	1075	dist. left	"	6.16.49
2273	1075	dist. right? ident.?	"	6.17.49
Tarsometatarsus				
~~2286~~	1083	distal ¾ left	"	6.18.49
Femur				
~~2260~~ meas	1075	distal left	"	6.16.49
Sterna				
2271	1075A	frag. ant.(left)	"	6.17.49
2281	1080	" " L, some costal	"	6.17.49
Rostrum(ident. ?)				
2293	1080	nearly complete	"	6.17.49

Miller & Bowman 1958 p. 12 Refers to Ph. kennicotti

Unmonographed material from the
San Diego Pliocene
January 24 - 28, 1950

Mancalla material need later for 1970 monograph ??

MANCALLA (17)

Bone no.	loc. no.	description	collector	date
HUMERI				
~~2303~~ measd	1080	comp. humerus, left	G. Kanakoff	1/24-28/50
~~2304~~ measd	"	" right (large)	"	"
~~2318~~ measd	1075A	prox. right	"	"
~~2319~~ measd	"	dist. left (large)	"	"
CARPOMETACARPUS				
~~2305~~	1080	prox. right	"	"
ULNA				
~~2306~~ mear	1080	dist. ¾ right	"	"
~~2323~~ mear	?	complete right (large)	"	1.28.50
SCAPULA				
2307	1080	inc. scapula, right	"	1/24-28/50
CORACOID				
~~2310~~	1080	complete right (large)	"	"
~~2321~~	1072	nearly comp. right	"	1.26.50
TIBIOTARSUS				
~~2308~~	1080	complete left (large)	"	1/24-28/50
2312	"	shaft left (small)	"	"
~~2320~~	1072	distal right	"	1.26.50
~~2322~~	?	nearly comp. left	"	1.28.50
VERTEBRAE				
2311	1080	3 (1 sure ident.)	"	1.24-28.50
PUFFINUS KANAKOFFI				
2317	1080	right carpometacarpus (2pcs)	"	"
2316	"	shaft tibiotarsus left (?)	"	"
GAVIA CONCINNA ?				
Pub 1955 (2314	"	tibiotarsus, dist. left	"	referred to G. howardae by Miller + Bowman, 1958 ; ")
COLYMBUS PARVUS				
2315	"	right humerus (2 pcs)	"	"
2309	"	prox. left	"	"
PHALACROCORAX ?				
2313	?	tarsometatarsus, dist. left (2pcs)		"
BRACHYRAMPHUS ?				
2324	?	prox. frag. humerus right	"	"

[Not measd Oct. 1, 1953] many were measured later + used in

Unmonographed material from
San Diego Pliocene
July-August, 1950

1970 monograph
part finished then crossed out.

MANCALLA (29)

Bone no.	loc. no.	description	collector	date
HUMERI				
~~2326~~	1075	Complete left and incomp. right	C. Kennell	July-Aug. 1950
~~2331~~	1071	Prox. left, and shaft	"	
~~2332~~	1071	Dist. ¾ right	"	
~~2339~~	1074	Incomp. right eroded	"	"
~~2343~~	1074	Prox. left	"	
2355	?	Nearly comp. right (large)	"	
STERNUM				
2325	1075	Both costal borders, etc.	"	"
~~2333~~	1071	Manubrium & 1 costal border	"	
2346	1072	Manubrium, part of keel	"	
2349	1072	Broken manubrium, frag. bord.	"	
2337	1071	Frag. costal border	"	
ROSTRUM				
2350	?	Incomplete (large)	"	
PELVIS				"
2340	1074	Sacrum andfrag. left pelv.	"	
TARSOMETATARSUS				
~~2327~~	1075	Complete left	"	
				"
ULNA				
2334	1071	Olecranon missing (large)	"	
~~2342~~	1074	Olecranon missing (small)	"	
RADIUS				
~~2335~~	1071	Complete	"	
TIBIOTARSUS				
~~2348~~	1072	2 halves separate (small)	"	
2356	?	distal end (large)		
CORACOID				"
~~2338~~	1071	worn, nearly comp. right (small)		
~~2345~~	1075	incomplete left (large)		
Carpometacarpus				
2352	?	distal right (small)		
FEMUR				
~~2342~~ ?	1072	worn prox. ¾ (small)		
SCAPULA				
2344	1074	blade only		
2357	?	blade only		"
VERTEBRAE				
2353	?	Two, identf.?		
2329	1075	One " ?		

UNMONOGRAPHED MATERIAL from San Diego Pliocene February 27-March 3, 1951

Mancalla bones
Many were used in monograph of 1950 but not listed by number herein. Those known to have been used are here ~~starred~~ only.

MANCALLA

Bone No.	Loc. No.	Description	Collector	Date
HUMERUS				
2442	1075	Complete	Kanakoff	2.27.51
~~2427~~	3228 Reynard	Complete	"	2.28.51
~~2430~~	1087	shaft (large)	"	2.27.
2441	1080	shaft (small)	"	
~~2432~~	1080	distal end (~~large~~ (size ?)	"	
ULNA				
~~2439~~	1080	Complete	"	
CORACOID				
2431	1080	incomplete	"	
TIBIOTARSUS				
2434	1080	Proximal half	"	
2443	1075	shaft	"	
CARPOMETACARPUS				
2433	1080	incomplete	"	
VERTEBRA				
2437	1080	ident.?	"	
FEMUR				
2435	1080	distal end, ident.?	"	
ROSTRUM				
2436	1080	ident.? Gavia?	"	
PUFFINUS				
Humerus no. 2444,	loc. 1080	nearly complete	"	
SPECIES ?				
HUMERUS 2438	loc. 1080	shaft (large)	"	Miller called "indet" & did not record
VERTEBRA 2440	"	incomplete (large)	"	
HUMERUS 2439	" 1087	incomplete (smaller)	"	

#2186 last monographed ~~#~~ for 1949
Later most of their more studies for 1970 monograph especially

UNMONOGRAPHED MATERIAL from ~~crossed out~~
San Diego Pliocene
Clifford Kennell, 1952-1954

MANCAILA (~~227~~) 86

Bone	Loc. no.	Description
HUMERI		
Left ~~2480~~ meas'd	1080	4 complete
~~2481~~ meas'd	1080	4 incomplete
~~2496~~ meas(Dome)	1128	7 incomplete
~~2504~~ meas	1075	1 complete
~~2505~~	1075	6 incomplete
CORACOID		
2482	1080	1 complete
~~2485~~	1080	2 incomplete
~~2498~~	1128	4 incomplete
ULNA		
~~2484~~ meas	1080	1 complete
~~2485~~ meas	1080	2 incomplete
~~2509~~ meas	1075	1 incomplete
~~2511~~ meas	1128	2 complete
RADIUS		
~~2486~~	1080	1 complete radius
CARPOMETACARPUS		
2487	1080	1 incomplete
TIBIOTARSUS		
~~2477~~	1080	1 complete(large)
~~2478~~	1080	1 complete (small)
~~2479~~	1080	5 incomplete
~~2510~~	1075	2 incomplete
FEMUR		
~~2507~~ 3 meas	1075	3 incomplete
~~2508~~ meas		1 complete
TARSOMETATARSUS		
~~2488~~	1080	1 complete
2489	1080	1 in matrix
2490	1080	1 proximal
~~2499~~	1128	5 incomplete
WING PHALANX		
2492	1080	
PEDAL PHALANX		
2493	1080	
~~2494~~ **VERTEBRAE**		
2494	1080	5
2502	1128	5 ident. ?
2503	1075	5 ident. ?
SACRUM		
2491	1080	2 incomplete
2501	1128	1 fragment
2512	1075	1 fragment
STERNUM		
2495	1080	1 anterior end
2415	1080	1 in matrix, ident.?
MANDIBLE		
2511	1075	1 fra. lower
2513	1075	1 frag. upper, ident.?
2514	1075	1 quadrate, ident.?
2500	1128	1 frag. lower

SCAPULA		
2506	1075	one

1 large, large meas 74.6 (166.1, 162.6, 161.3)
1 small
2 large (dist)
1 dist, size?
2 prox, small
1 prox, large?

118
22
52
21
18
58
380

59

UNMONOGRAPHED MATERIAL
San Diego Pliocene
Clifford Kennell, 1952-1954

SHEARWATER (3)

Bone no.	loc. no.	Description
1958- 2516	1080	3 humeri (1 dist. end, only) Miller & Bowman 1958:8

GREBE (6)

2517	1080	1 tarsometatarsus
2518	1080	1 prox. ulna
2519	1080	1 sacrum
2520	1128	1 tarsometatarsus
1958 → 2523	1075	2 scapulae rec'd by Miller & Bowman 1958, p. 5 one mead

CORMORANT (2)

Recorded 1958 2528	1080	1 femur Ph. kennelli according to Miller & Bowman 1958:12
2529	1080	1 ulna

AUKLET (2)

2530	1080	1 tibiotarsus
2531	1080	1 coracoid

MIOSULA? (2)

1958 2521	1128	1 femur
✓ 2522	1128	1 fragment of coracoid } both referred to Sula humeralis, Miller & Bowman 1958:10

SPECIES? (5)

2524	1075	2 incomplete tibiotarsi
2525	1075	1 incomplete femur
2526	1075	1 prox. frag. humerus
2527	1079	1 ulna

UNMONOGRAPHED MATERIAL

Later used in 1970 Mancalla monograph especially true crossed out

Mancalla
San Diego Pliocene
December, 1952 and July, 1953
(Also Dr. Miller's material of March 15, 1951)

Dr. Miller's Material (2345) (15)

CORACOID	nearly complete, small
SCAPULA	1 large proximal 1 nearly complete
FURCULA (ident.?)	tip end only
HUMERUS	2 prox.(1 large, 1 small)
ULNA	1 complete
CARPOMETACARPUS	1 complete
FEMUR	1 large 1 small complete
TIBIOTARSUS	1 larger, nearly comp. 1 medium size (good) comp.
SACRAL FRAG	
MANDIBLE (ident.?)	articular end
PEDAL PHALANX	~~two~~ one
TARSOMETATARSUS	nearly complete, small

....L.A.C.M. 2...Mancalla

(21)

SCAPULA	Loc. 1071	prox. 2/3	Kanakoff and Downs		12.11.52
~~2536~~	~~101~~ 1071	prox. 1/3	"		"
	~~121~~ 1080	prox. 2/3	"		12.10.52
HUMERUS ~~2537~~	1071	lacking dist., tip meas.	"		12.11.52
~~2538~~	~~101~~ 1071	2 prox. meas.	"		12.11.52
~~2539~~	1071	3 dist. half	"		"
	~~1071 stet~~	" "	"		"
(3)	1071	" "	"		"
2540	1080	" "	"		12.9.52
CARPOMETACARPUS	~~107~~ 1095	complete right	"		12.11.52
~~2541~~ 2542	~~121~~ 1080	" left, large	"		"
	101	nearly comp., left, in mt.	"		"
ULNA 2543	121	right in mt.	"		12.10.52
2544	1095	left in mt.	"		12.14.52
Carpometacarpus 2545	1079	distal 3/4 tiny	Kennell		7.18.53
TIBIOTARSUS ~~2545~~	101 = 1071	dist. half	K. and Downs		12.11.52
2546	101 = 1071	prox. half	"		"
2547	105 = 1075	dist. half, well worn	"		12.13.52
TARSOMETATARSUS	1071	comp. small			12.11.52
2548					

~~Rib~~ 2 1 complete

Tibiotarsus 2549 complete Kanakoff 1955 (1080)

ca 9.1955

UNMONOGRAPHED MATERIAL
San Diego Pliocene
1954-1955 (museum personnel)

Most of Mancalla material used in 1970 studies by HH crossed out here. Other published notes written in here now, also

MANCALLA - 13 ~~15~~

HUMERI

~~5~~ ~~2553~~	1071 meas	1 complete	Downs, 6.26.54
15 meas 2554	1071	(2) prox. ~~fxxxx~~	" " " "

CORACOID

2555	1071	1 nearly complete	" " " "
2556 2559	1071	2 fragment	" " " "
	1071	1 complete	

ULNA

~~2552~~	1071	1 complete	" " " "
~~2558~~	1071	2 incomplete	" " " "

TIBIOTARSUS

~~2550~~	1071	1 large complete	" " " "
~~2551~~	1071	1 small distal	" " " "

TARSOMETATARSUS

2557	1071	1 incomplete	" " " "

VERTEBRA

2565	1072	~~xxxxxxx~~ ident.?	" " " "

GREBE

2560	1071	shaft humerus	as above
2564	1072	2 frags. same prox. half humerus	as above
2562	1071	1 distal	
Sp? 2561	1071	1 complete carpometacarpus	
" 2563	1071	1 prox. radius	Miller & Bowman C. parvus 1956:4
X (2) " 2572	?	1 comp. tarsometatarsus	refer to Pufferus, Kanakoff, Miller & Bowman 1956:8
MANCALLA 2567	1080	1 frag. radius	Kanakoff, May, 1955
2549	1080	1 complete tibiotarsus	" " "

~~CORMORANT or MIOSULA~~ → P. kennelli by Miller & Bowman 1956:11

referred to 2566	1080	1 complete tibiotarsus	Kanakoff, May, 1955

1952 Downs and Kanakoff

GREBE

Type Colymbus subparvus 2568	1080	1 incomp. femur	Kanakoff and Downs 12.11.52 Miller & Bowman 1958, p. 6.
2571	1071 (101)	1 incomplete tarsometatarsus	K and D 12.11.52
2570	1071	1 prox. tarsus	D. 12.11.52
1958 Rec'd 2569	1071 (101)	prox. 2/3 femur	K 12.11.52 → Miller & Bowman 1958, p. 5

1958 Quoblet

2573	1079	Complete ulna	Kennell 7.18.53 B. pliocenus @ T Miller & Bowman 1958:13

Sp.? (mancalla)

2574	1079	wing phalanx	" "

Later used for studies/publications 1970 (HH) especially true crossed out.

UNMONOGRAPHED MATERIAL
San Diego Pliocene
1955 - 1960 (Kennell, Kanakoff, Arndt)

MANCALLA (40 + 10 including next page - total 50

Bone No.	Loc. No.	Description
HUMERI		
2641	LACMIP 169	complete Small, from Jos. Arndt, 1.20.57
2643	VP no. 1074	Prox.
~~2644~~ meas	1074	Distal and shaft (2 specimens)
~~2646~~ meas	2400 Reynard	Prox, from Arndt 1.15.57
2637 not meas, (1 prox = small)	1080	3 fragments
2658	Tecolete Canon	prox. Arndt 6.29.57
~~2659~~	1095	shaft " "
meas ~~2670~~	3500 Reynard Very large	Large completem Arndt Nov. 1957
~~2675~~ meas	1080	incomplete Kanakoff, june 1952
~~2676~~ not meas	"	" " " "
2677	"	" " " "
meas ~~2678~~ large also small one with same # not meas	"	" " " "
~~2679~~ meas	"	prox. fits. distal no. 2540, Downs 12.52
meas ~~2688~~	1075 large?	distal (Teny Gracatone, June 1952
meas ~~2695~~	1079 large	complete large Lewis Johnson, Apr.1958
CORACOID		
~~2627~~	1080	Complete Kennell, 1955
2642	LACMIP 169	small nearly complete Arndt 1957
2685	1080	incomplete Kanakoff, June 1952
2686	"	" " " "
ULNA		
~~2638~~	1080	badly eroded Kanakoff, 1956
~~2690~~	1073	frag
RADIUS		
~~2632~~	1080	Complete Kennell, 1955
CARPOMETACARPUS		
2636	1080	Incomplete Kanakoff, 1956
2684	1080	2 incomplete Kanakoff, 1952
~~2650~~	1080	Complete? Arndt 1957
TIBIOTARSUS		
~~2628~~	1080	Complete Kennell 1955
~~2635~~	1080	Distal Kanakoff, 1956
~~2680~~	1080	Incomplete Kanakoff 1952
2681	1080	2 incmplete " "
~~2683~~	1080	incomplete " "
~~2691~~	1074	distal " "
FEMUR		
~~2668~~	1074	proximal
~~2672~~	3500 Reynard	distal (idnetification?) Arndt 1957
~~2681~~	1080	incomplete (distal) (Kanakoff 1952)
~~2690~~	1073	incomplete

UNMONOGRAPHED MATERIAL
SAN DIEGO PLIOCENE
1955 - 1960 continued later some monographed esp Mancalla 1970

MANCALLA continued

Bone no.	Loc. no.	Description
TARSOMETATARSUS		
meas for 1970 ~~2682~~	1080	complete?
SKULL		
2629	1080	dorsal part
2633	1080	parts of skull and mandible Kanakoff 1956
2634	1080	upper and lower mandibles, tip ofbea Kanakoff 1956
PEDAL PHALANX		
2631	1080	
2657 ????sp?	LACMIP 307	Arndt 1957 sp.?
SCAPULA		
~~2654~~	LACMIP 307	Arndt 1957
VERTEBRAE		
2630	1080	Kennell 1955
2639 sp??	1080	5 vertsKanakoff 1956
RIBS		
2640 Mancalla?	1080	2 ribs

Mancalla 13 Studies for 1970 monograph

meas. Lang	6180	Prox + dist Humerus (same bone, no middle?)	1075'	Arvey 1962
meas L?	2816	shaft "	1075B	
meas? meas	2819	shaft spart dist "	1075'	
meas L	6182	complete "	1075B	Arvey 1962
meas	2813	" "	1071	
S	2824 meas.	" "	1075'	
S	2850 meas	" "	1075	
S	4456 meas distal humus		1075B	
S	2818 meas prox	"		
S	2804 meas	" "		
S	2802	" " "		
S	not meas complete	"		
S	2842 meas une	"		

1071

Total 64 since Mellet Bowman 1958

Unmogographed material from
San Diego Pliocene
July-August, 1950
continued

PUFFINUS

HUMERUS

2328	1075	Incomplete right (no ends) Kennell
2648	1080	Humerus Kanaloppa July 1954

COLYMBUS

2354	1079 ?	Nearly complete left Miller + Bowman refer to C. subparanus 1958:6
2649	1080	"Grebe" + tibiotarsus Kanaloppa July 1954

2605 Distal half femur grebe sp. Miller + Bowman 1958:7

CORMORANT

2645	1074 3280 Reynard Way	Tibiotarsus

Sp. ?

2647	3400 Reynard Way East slide	Vertebra Arndt 1.15.57
2651	1071	Pelvis frag. G.P.K 12.11.52
2652	1075	Vertebra 1954
2653	1071	Furcula G.P.K 12.10.52
2655-56	307	Vertebrae Arndt 4.24.57
2657	307	pedal phalanx " "
2660	1071	dist. tibiotarsus G.P.K, 1952
2661	1080	frag. sternum " "
2662	1128	frag. low. mandible May 1954
2663	1075	femur Kennell Apr. 1954
2664	1071	humerus shaft Downs 6.26.54
2665	1075	Coracoid Quibler? Kennell 10.3.55
2666	1075	frag. sternum " "
2667	1075	Vertebra " "

Studied & Monographed 1970

UNMONOGRAPHED MATERIAL

MANCALLA 10 → Corona del Mar area
Pliocene (loc. 1067) → 10

HUMERUS ✓2577 distal half very large
~~✓2574~~ proximal end, right (large) Fred Feltham, 1952?

TARSOMETATARSUS ✓2250 nearly complete, left (large) Kanakoff and Bessom, 12.17.48

TIBIOTARSUS ✓2424 right, lacking distal end (L) Feltham 4.3.50

CORACOID ✓2581 top half of right (large) Bewns

loc. 1066 -- Newport Bay mesa
adjacent to 1067, but heretofore yielding only
Pliestocene specimens

CARPOMETACARPUS incomplete #2583
" nearly complet ✓2578
" incomplete 2625

ULNA lacks dist. ✓2580

RADIUS complete ✓2579

Three ✓ were (8 specimens) recorded Harvard 1970 Sac Mem Contrib Sci # 203 p. 3.

1067 specimens recorded 1949

Mancalla calif. 1 carpometa. 2033
2 shafts tarso. 2034 (both same #)
1 vertebra 2035

Puffinus felthami n. sp.
type - humerus # 2037
ecotype tarso. (mic. # 2038
Repeats that 14 bird bones found - 8 identified

Ph 1, Dig 3 wing } 2039 referred?
quadrate

? 2282 corrected

UNMONOGRAPHED MATERIAL
San Diego Pliocene
in L. A. COunty Museum collections

MANCALIA – 225

Humeri -- 62 (of which 13 are complete)
Coracoids 26 (" " 7 " ")
Carpometacarpus -- 14 (3 are complete)
Radius -- 5 (2 are complete)
Ulna -- 21 (8 are complete, but two are in the mount)
Scapulae -- 9
Sternum -- 9
Femur -- 10 (1 tiny one is complete)
Tibiotarsus -- 32 (5 are complete)
Tarsometatarsus -- 16 (3 are complete)
Phalanges (wing or pedal) -- 4
Vertebrae (identification uncertain) -- 24
Skull and jaw fragments (identification uncertain) -- 8
Pelvis or sacrum -- 5

GREBE -- 38

SHEARWATER -- 9

CORMORANT -- 5

LOON -- 1

AUKLET -- 3

MIOSULA? -- 2

BULL -- 1

62
26
14
5
21
9
9
10
32
16
4
24
8
5
225

[rems. 1949]

Maricala bones from San Diego — Studied 1970

Used in statistical study

Coracoid
- 2067 [1949]
- 2087 [1949]
- 2208 [wr 1075 mrd]
- 2276 wr 1071
- 2229
- 2290
- 2338
- 2310
- 2422
- 2497
- 2498 wr 1128
- 2557
- 2559 wr 1071
- 2627 [wr 1080]
- 2849

Scapula
2070 [1949]
2049 [1949]
2176 [1949]
- 2252
- 2278
- 2297

incomplete
- 2536 Snacks
- 2536 L
- 2536 L

2506
- 2654

Humerus
2062 [1949]
2066 [1949]
2084
2096 [2 bones wr 1949]
2080
- 2206, 2135
- 2098
- 2207
- 2230
- 2281, 2280
- 2291
- 2292 2296
- 2290
- 2218
- 2077
- 2219
- 2269, 2259
- 2304
- 2314
- 2326
- 2318
- 2303 (mt)
- 2343
- 2304, 2319
- 2331
- 2355
- 2322
- 2427, 2432
- 2480 (4 bones)

(2) 2481, 2490
2496
- 2670, 2675
- 2673 2679
- 2695
- 2646 2644
- 2679, 2648
- 2507
- 2504 2550 (3)
- 2538
- 2537 (2 bones)
- 2553, 2558, 9
- 2554

(2813)
2816
2850
2842
2824
2892
6182
2819
7731
no II
6456
6180
(2) 6181

Ulna
2064 [1949]
- 2287
- 2337

2323 } Large
2101 [1949] } + one no II
2179 [1949]
2082 [1949]
- 2342 [1949]
2069 [1949]
2079 [1949]
- 2497 (2)
2552
2558
2439
- 6426
2484
2082
2509

(Rudii #'s
4 large
3 small

2248
2323
- 2257
2690
2498
2982
2342
2104
2294
2485
2484
2638
2306
2509
2832
2538
2258
2587

Carpometa
5' large
5' small
2068 [1949]

Femur
2078
2076
2097 mrd [1949]
- 2507
2672
"Tyto"
2185
- 2508
2545 "Haust. calcar"
"3" 2845
2220
2221
2270
2185
2186
- 2347
2548
2221 inc
2244 inc
- 2240
2227 incl wr 1080
2078 inc
2137 inc
- 2468
- 2472
- 2681 (with tibia)
6025
2227
2145
- 2690
2692

Type milleri

2834, 2835
6183 (3)
2844 2845
2085
2089 2683 2691
2100
2125 [1949]
2177 [1949]
2320 Large
2322
2308
2477 2635
2550 2223 2510
2259
2083 [1949] wr 1080
2071 2085
2085
2283
2209 Small
2210
2286
2348
2345
2510
2478 wr 1080
2581 2550
2549 (wr 1080
2628 wr 1080
2479
2105 [1949]
2134 [1949]
2308 2635
2471
2294 2480
2575
2630
2691 2320
2322
2079
2479
2681
2545
2510
2479
2478
2286 (1080)
2108
2671
2375
2428

Tarsometatarsi
2177 [1949]
2178 [1949] } Large
2499

2327
2488
2548
2682 } Small
6454

2090
2220

Sternal frags
- 2333 [1970]
dupes
2063 [1949]
2150 [1949]
cranium/rostrum
2633 [1970]
dupes

Pelvis
2282 [1949]
2205 [1950]

Sk 2205

1970 notes re: mrd specimen

---

assigned to milleri, 1970
1970 [specimens with length meas.; not including those pub 1949]

complete		incomplete	
Coracoid	12	scapulae	13
humeri	25	sterna	5
ulnae	16	pelves	2 (+ 2205)
radii	6	crania	1 = 2633?
carpo.	7		
femora	8	pelvis	
tibiae	8	2281	
tarsi	5	2270	
		2165	

- femur 2097/no H
- tibiotarsus 2177 [1949]
- skull 2205
- pelvis 2282
- sterna 2063
- coracoid 2243/2208
- scapes not #'d
- humeri 2442/2303
- radius 2335 (8?)
- ulnae 2543/2544
- carpo 2213/no #

only one in 1970?

Tăucalla bones – San Diego Monograph 1970

Humeri studied for 1970 paper

2062
2066
2084
2080
2096
2077
2098

2135

~~2204~~
~~2207~~
~~2230~~
~~2231~~
2218

~~2219~~
~~2223~~
~~2251~~
2269
~~2289~~
~~2296~~
~~2292~~
2281
~~2280~~

~~2303 (mt)~~
~~2304~~
2314

~~2318~~
~~2319~~
~~2326~~
~~2343~~
~~2355~~
~~2332~~
~~2339~~
~~2331~~

~~2427~~
~~2432~~
~~2430~~
~~2496~~
~~2480 (46 bones)~~
~~2481 (2 bones)~~
2490

2501
2502
~~2505~~
~~2504~~
~~2537~~
~~2538~~
~~2539~~
2558
~~2553~~
2574
2574
2576

2637
~~2644~~
~~2646~~
~~2659~~
~~2670~~
~~2675~~
~~2676~~
~~2678~~
2673
2688
~~2679~~
~~2688~~
2677

2724
2802
2805
2813
2816
2818
2819
2824
2842
2850

Ulna

2044
2069
2029
~~2082~~

210
2179

2251
2248
2287
~~2294~~
~~2257~~
2248
2294
2256

~~2306~~
~~2323~~
2340
2318
2326
~~2303 mt~~
2337
~~2439~~
~~2484~~
~~2485~~
2498
2489
2497
2358
~~2509~~
~~2558~~
2587
~~2552~~
~~2438~~
2690
2832
2982

6424

Radius

~~2274 S~~
~~2238 L~~

~~2486 L~~
2567 L

~~2632 S~~
2812 L

V5519 ulna (UC?)
2335 mt

Carpometa

2068 (2)
2060
2213 (mt)
2242
2223

~~2305~~
2345 (? museum UCLA) → 5th Metacarpal
~~2541~~
~~2542~~

~~2650~~
2825

2545/2060

Tibia

2053
2085
2071
2088
2089

2100
2105
2125
2134
2177
~~2108~~
2134
2108

-2209
-2210
-2259
-2286
-2283
2294 42.
2223

-2308
-2322
-2375
2345
-2348
-2320
2471
2479
2478
-2477

-2510
-2550
-2551
2549
-2575

-2480
-2635
2628
2471
-2628
2630
-2683
-2691
2881
2865
2834
2835
2895
2845
2884
2844
6183

Tarsometa
2177 met
2178 (lor 1071
2499
-2327 (1075)
-2488
2548
2682
2831
6454

2507 L r S
2078 L
2672 L
2137
2848 S
2508
2135 S
2260 S
2244 S
2221 S
2681 L
2668 L
2227 S
2507 S
-2186 S
2377 S
-2224
2245 (met
2499
6454 (1075 B
6455 (lor 1075 B)
2499 (shaft)
-2232
-2682
2091

S.D. #6 area monograph of 1949

Some now recorded as of 1971

2187–2191 –	C. pavo
2192	Cormorant
2193–2202	sp?
2203	C pavo
2204–2219	Maucalla
2220	C pavo
2221	Maucalla
2222	sp
2223–2224	Maucalla
2225	C pavo
2226–2238	Maucalla
2239–2241	pavo, Puffinus pavo
2242–45	Maucalla
2246	Shearwater
2247	pavo
2248	Maucalla
2249	sp
2250–53	Maucalla
2254–55	sp
2256–61	Maucalla
2262–64	sp
2265–68	pavo
2269	Maucalla
2270–71	pavo? + sp.
2272–80	Maucalla
2281–82	sp. + Cormorant
2283–85	Maucalla, pavo + sp.
2286–90	Maucalla
2291	pavo
2292–97	Maucalla (except 2295?)
2298–2300	pavo, Cormorant, sp.
2303–08	Maucalla
2309	pavo
2310–12	Maucalla
2313	cormorant
2314	Gavia howardae
2315–17	pavo (1), Puffinus 2

2318 - 23 Maucalla

2324 Brachyramphus

2325 - 27 Maucalla

2328 communis or Uria aalge? humeri

2329 - 2349 Maucalla (except 2336, 2341 Np.)

2350 - 53 Np

2354 Subparvus

2355 - 58 Maucalla

2427 Maucalla

2428 Np.

2429 - 34 Maucalla

2435 - 38 Np.

2439 Maucalla

2440 - 41 Np

2442 - 43 Maucalla

2444 P. kanahopkei

2477 - 2515 Maucalla

2516 P. kanahopkei

2517 - 20 parvus

2521 - 22 Sula hunnadis miller + B. murrey X

2523 Grebe

2524 - 27 Np.

2528 - 29 Kennicotti

2530 - 31 Brachy.

2534 - 59 Maucalla

2560 - 64 parvus

2565 Maucalla

2566 Kennicotti

2567 Maucalla

2568 subparvus

2569 - 71 parvus

2572 Np.

2573 Brachy.

2574 Np.

2575 Maucalla

2576 - 83 Corvus del Mar Maucalla

2605 Grebe

2605 last # on prev. page

2627–39 Maucalla
2640 sp
2641–44 maucalla
2645 comrant
2646 Maucalla
2647 sp.
2648 Shermatia
2649 Jobs
2650 Maucalla
2651–53 sp
2654 Maucalla
2655–57 sp
2658–59 Maucalla
2660–64 sp
2665 ambit
2666–67 sp
✓ 2668 Maucalla prox femur
2669 lulid. lapt coracoid
✓ 2670 Maucalla lapt humerus comp.
2671 sp dist. tibia
✓ 2672 Maucalla? dist femur
2673 sp. vert

2675–88 Maucalla vic. ✓ humeri (Hum 2679)
2689 sp shell frag ✓ 2680 tibia
2690–91 Maucalla frag ✓ 2681 ?, 1 femur
2692 sp dist. femur ✓ 82 tarsus
2693 P. pius humerus nearly comp. ✓ 83 tibia
2694 sp, frag femur + hum ✓ 84/2 carp
✓ 2695 Maucalla comp. humerus ✓ 85 ✓ 86 coracoid
87 skull
✓ 88 dist humerus

No.	La.	Unmonographed ~~Non Paucalata~~	
2648	1080	Puffinus humerus lacking complete ends	Kanakoff July 1956
2649	1080	Grebe? distal end tibiotarsus	" " "
2645	1074	Cormorant tibiotarsus lacking prox end.	← no data
2651	1071	fragment pelvis (alcid?)	→ 12.11.52 (GPK?)
2665	1075	Alcid (tiny) coracoid	Kennell 10.3.55
2669	1074	large sulid coracoid	J & Arndt Nov 1957
2653	1071	furcular symphysis (small)	12.18.52 (GPK?)
2660	1071	large turkey like distal tibia (Recent?)	G.P.K. 1952
2662	1128	articular end of ramus	no data
2689	1075	fragments of skull, T vertebra	Kanakoff 6.18.52
2663	?	distal end radius Paucalata	no data
2686	1080	frags of coracoid, Paucalata	GPK 8.20.52
2643	1080	Puffinus, humerus lacking distal end	Kanakoff 6.18.52
2657	?	pedal phalanx - sp?	no data
No #	no data	Very squat, heavy vertebra	no data collectors?
2681	1080	2 distals Humeri, 1 prox, femur Paucalata	assid bones
2587	1075	frag distal end tibiotarsus Paucalata?	no data
2652	1075	Vert. small	" "
*2694	LACMIP307	dist femur Paucalata? large	Arndt March 1957
		T frag humerus "	
35	1080	Distal end coracoid (cormorant?)	no data
6923	1075B	C. pavour tibiotarsus - distal	→ Arney 4.9.63
6927	1075B	Cormorant coracoid (2 pcs)	Kanakoff 1962
2824	1075	Paucalata humerus	G.P.K. July, 1962
2825	1075	" carpometa	
2826	1075	grebe? shaft of humerus (2 pcs)	
2827	1075	Puffinus carpometacarpus	
2828	1075	sp? 2 vert	
2829	1075	grebe sternum frag. costal edge Manubrium with it?	
2830	1075	sp.? distal end ulna	
2809	1080	Colymbus parvus complete tarsus	GPK July 1962
2810	1080	shaft tibia sp?	
2811	1080	ulnar frag? sp?	Jules Craig 8.21.61
2812	1095	radius Paucalata	
2655	Jacnip	2 vert, sp?	Arndt 4.25.57
2656	907		Arndt 4.5.58
2835	1078	tibia distal - Paucalata	
2836	1078	prox ulna - grebe	
2837	1078	vert sp	GPK July 1962
2850	1075	Paucalata complete humerus	
2849	"	" coracoid	
2848	"	" ? sacrum	
not Rec 2847	"	" femur small	Arney 9.5.62
6182	1075B	Paucalata comp. humerus	Jake Fitch April 1950
2833	1080	Cormorant humerus (no proc)	
2834	1080	Paucalata ½ tibia	

uncatalogued

complete ulna	Mancalla	Richmond St. CA S 62, fig. 2, pl. 13, U.2 Mem, coll'd by J. F. Arndt 3.8.58
prox end "	small (alcid?)	
vertebra	?	

ulna (no distal)	Puffinus?	3500 Reynard Way 1072 J. F Arndt 3.8.58
pedal phalanx	sp?	

distal half of ulna	Puffinus?	LACMP 312 Ecological amphitheatre near Marine Blvd. J. F Arndt Dec 1957
" end large tibiotarsus	Mancalla?	

manubrium sternum	sp?	6.26.54, Washington Blvd
2 frags tarsus	Mancall 1075 B	Arney July 1962

2813	1071	comp. Mancalla humerus	QPR 7.11.62
2814	1071	prox grebe tarsus	
2815	1071	sh. tibia sp	
6924	1075 B	dist tibia Mancalla	Arney April 9, 1963
6925	1075 B	ulna Mancalla	
6926	1075 B	frag sternum sp?	
6454	1075 B	tarsus complete Mancala	Arney Sept 12 1963
6455	1075 B	" distal "	
6456	1075 B	humerus " "	
6457	1075 B	coracoid frag "	
6458	1075 B	dist tarsus cormorant?	
6183	1075 B	3 dist. and tibia Mancalla	Arney Sept 5, 1962
6185	1075 B	frags. humerus alcids →	
6180	1075 B	prox + dist humerus "	
6186	1075 B	manubrium sp.	
2816	1075 B	distal humerus Mancalla	Kanaly July 1962
2817	"	— prox humerus cormorant	
2818	"	" tibia mancalla?	
2819		— small frags sp?	
2820		— 4 vert + sacral frag sp?	
2821		— complete ulna Puf. Kanaly	
2822		— distal coracoid Mancalla?	
2823		— distal tibia Mancalla large	

correct #?

Unmonographed San Diego Pliocene

~~6424~~	~~1075B~~	~~Tibiotarsus - distal~~	~~Anseranatidae~~
2831	1080	prox + dist. ends	tarsometa (Anseranas)
2832	1080	prox end ulna	
2838	1095	(Locality 107) complete femur, grebe	
2839	1095	almost complete femur + tarsus (nice)	
2840	1077	pedal phalanx, sp?	
2841	1074	grebe scapula	
2842	1071	2 frag. humus Mancalla	
2843	1071	Tibia, dist., Mancalla	
2844	1079	" " "	
? 2845	#?		
6187	1080	Sternum (manubr.) Mancalla	
6188	1080	Sternum, grebe (xiphoplast.)	
6184	1075B	frag. Mancalla coracoid	
2464	1071	frag humerus, grebe?	
2673	?	east side Rayner vert. sp?	
2741	1080	frags - grebe?	
2692	1080	?	
~~2665~~	~~1075~~	~~coracoid~~ almost complete	
~~2689~~	~~1074~~	~~frags, tibia~~ + vert sp?,	
~~2669~~	~~1074~~	large subid comp. coracoid	
~~2648~~	~~1080~~	~~Puffinus humerus~~	

~~Anseranatidae~~ 9 P.K 4.16.60

" "

Louis Johnson Jr. 3.29.58
" " " " "
9 P K 4.16.60
" July 1962
" 4.16.60
" 12 10.57

Louis Johnson Jr. 4.5.58
Arndt. 4.5.58

Arney 9.5.62
Arney 9.5.62

Arney 9.5.62

T D 6.26.58
——?

9 P K 26 March 1957

9 P K 6.15.52

Kennell 10.3.55

9 P K 6.15.52
Arndt 11.57

1.28.64

Unrecorded San Diego Pliocene

2694 - distal end femur - large Mancalla ?

2282 - upper end coracoid - P. kennelli ?

? low " " P " ?

6927 coracoid in 2 pcs. Phalacrocorax sp. (large - dif Dam kennelli.

unnumbered ulna Mancalla mid Cay Andrs fr 2, bl 13, 1958

" ulna Puffinus (gabri?) Cand to 3500 Reynd LACMIP 102

" Tibia dist Mancalla?, very large dist) Tec Roto amphitheatre LACMIP 312

" ulna dist Puffinus

2835 dist tibia large Mancalla

2836 prox ulna grebe?

2821 coracoid " P. lewisi

2818 prox tibia + prox tarso

2823 dist " "

2816 humerus large Mancalla

2817 prox " Phalacro.

2827 carpometa Puffinus

2826 frag sh. humerus grebe

2830 sp? dist ulna

2824 humerus) Mancalla

2825 carpus)

2829 frag sternum - grebe

no # dist end sternum sp? Work Bluff 1954

2812 radius - large Mancalla

2809 tarsus Col. fasciatus

2810 tibia shaft sp?

6924 " dist Mancalla

6925 ulna "

6926 frag sternum sp?

6454-55, 2 tarsi Mancalla

6458 dist tarsus cormorant?

6456 " humerus Mancalla

6457 frag coracoid ?

2831 tarsus in 2 pcs Maucalla
2832 prox tibia "
2850 comp humerus "
2847 " femur "
2849 " coracoid "
2848 sacrum "?
6182 comp. humerus Maucalla
6183 three dist tibiae "
6180 humerus in 2 pcs "
6181 2 mic humeri "
6184 frag coracoid "
6187 ant end sternum "
6186 " " " sp?
2833 3/4 dist humerus Phalacrocorax
2834 dist tibia Maucalla
2507 prox frag femur "
6188 sternum - grebe
6185 alcid humerus
2686 frag cora Maucalla
2715 Hum in matrix, sp?
2664 complete coracoid large sulid
2665 coracoid sp small
2645 tibia comorant
6183? prox carpus grebe?
2587 dist tib Maucalla
2662 " femur "
2668 frag sternum sp
2438 sm humerus albatross?) Miller
2439 " " sp) sand index
2211 furcula "
2530 tibia 2 pcs alcid? @ ☆ Miller but not pub.
2648 Puffinus humerus
2649 dist tibiae gobi?
2839 femur + frag tarsus - small alcid
2838 comp femur grebe
2842 prox humerus Maucalla
2844 dist tibia "
2845 " " 2 pcs "
2841 scapula grebe

Already Blue (Maucalla deposits dist, by Mr.)
largest humerus 2220 (11.1 mm.)
la Mar " 2097 9.3

313
8) 25.04
24
104

545.00
25.04

3.13
21.5

2504) 545.00
5008
4420
2504
19160

Dup. Next on other list

#'d 2477 – 2495 inclusive

Locality 21 = 1080

Mancalla ~~19~~ 36

2 complete tibiotarsi
2 ~~distal end~~ incomplete tibiotarsi
2 complete humeri
~~2~~ incomplete humeri
1 complete coracoid
2 incomplete coracoid
2 incomplete ulnae
1 complete tarsometatarsus
1 wing phalanx
1 pedal phalanx
1 sacrum

Shearwater

~~3~~ humeri 2516

Grebe 3

1 tarsometatarsus 2517
1 proximal end ulna 2518
1 sacrum 2519

Fragments, various species -- 10

2515 Matrix with sternum
3 pieces of matrix with bones, not yet identified

Exposures along Washington St. (1400 blk) to Mission Valley Highway 395 50 feet up from street level. April 20 and 21, 1954.

Mancalla ~~19~~ 25

2496 7 incomplete humeri
2497 2 complete ulnae (one listed on p. over) both near
2498 4 incomplete coracoids
~~1 nearly complete femur~~
2502 5 vertebrae
2499 5 incomplete trsometatarsi
2500 1 fragment lower mandible
2501 1 sacral pair

Grebe 1

2520 1 tarsometatarsus

Miosula? 2

2521 Fragment of coracoid
2522 femur

Miscellaneous fragments bird and fish

4 sand dollars, ~~2 limpets~~, 1 crab claw

Duplicate of earlier p. dated 1952-54

25
36
3
3
2
2
2
24
2
4
1
107

19
12
11
8
19
49.

Not #'d on bones

=1075

Locality 5 — 2 Mancalla

Mancalla

2504 1 complete humerus
3 incomplete humeri ← 2505 → 3 incomplete humeri (duplication)
2506 1 scapula
1 incomplete femur ↔ 2508 1 complete femur
2509 1 incomplete ulna ← 2507 → 1 incomplete femur
2513 1 rostrum ? 2510 2 incomplete tibiotarsi +
2514 1 quadrate ? 2503 5 vertebrae?
2512 1 fragment sacrum 2511 1 fragment lower mandible

Grebe

2523 2 scapulae

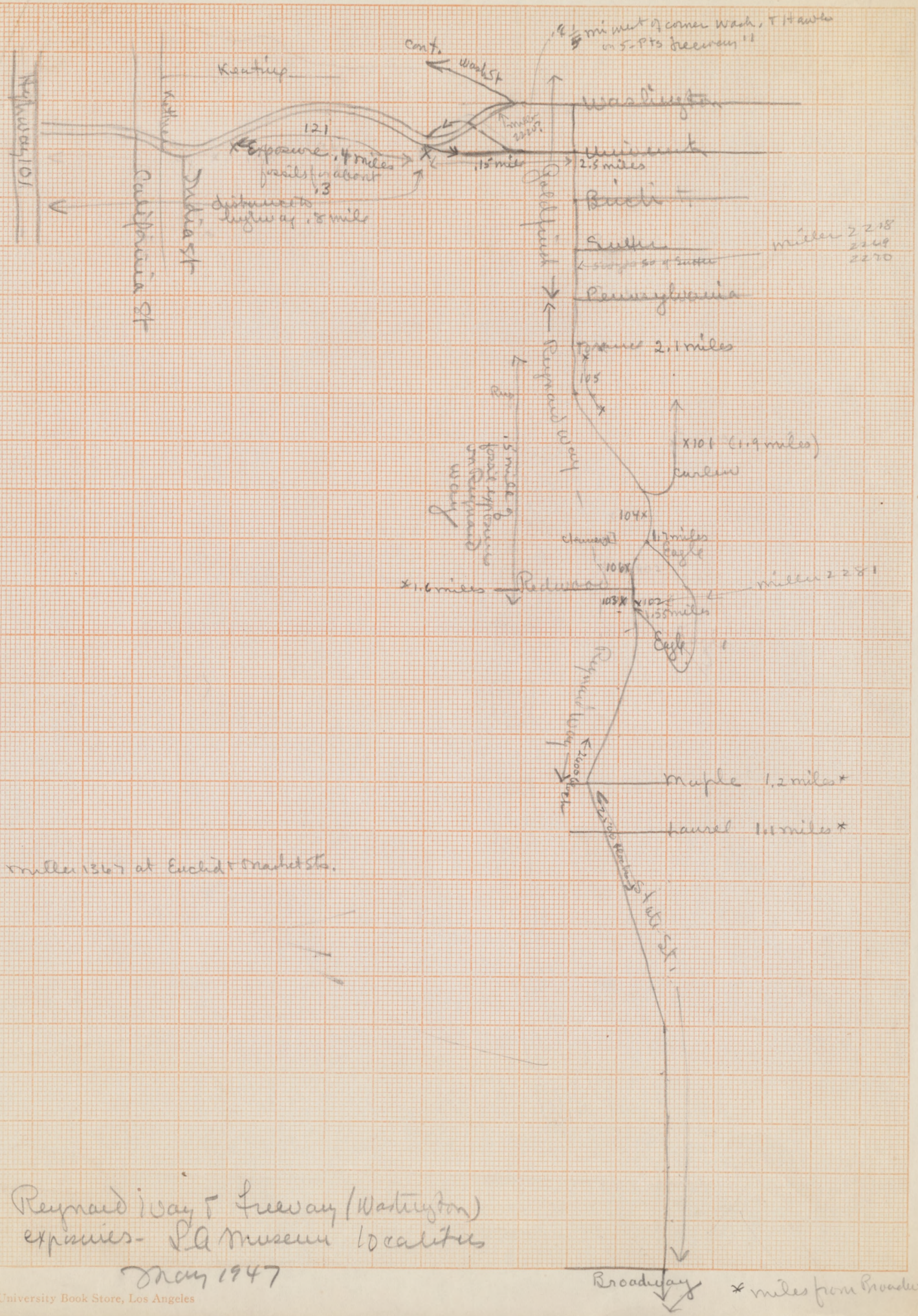
Species?

2524 2 incomplete tibiotarsi
2525 1 incomplete femur
2526 1 proximal fragment humerus

=1079

Locality 20 — 3.5.54

Species? -- 1 ulna 2527



No. 6313, University Book Store, Los Angeles

Mancalla from San Diego

Coracoid

large, left

abart comps, no head: 2498, 2482, 2087 49, 2483

mt: 2067, 2310, 2290 — abart complet

mt: 2242, 2184, 2421 49?, 2269 top only — notop

another unopathied coracoid! Trial 7

small left

complet: 2627

essentials complet: 2558, 2208, 2559, 2276

sternal end missing: 2208 mt, 2090

top only: 2104

2345 frag onto 2498

mt: 2224, not #, 2338 (49?), 2498, 2321, 2243 mt — essentials complet

2106 sternal end missing

2498, 2556, 2556 — glenoidaea

Scapula

large left

½ innie 2506

leadenly 2357

may be small?

mt: 2654 acr. end, 2176 macthay ½, 2049 ½

small left: 2278, 2297, 2528, 2070 mt

mt: 2167, 2536, 2536, 2536, 2330 mt, 2086 may be large?

Sternum

2333 large? good

2076 costal margin

4 mid unopathied frags ??

2063 small good MT

2325 small good

2180 " ? "

2346 " ant. 49

2495 " " (fits 2661)

2181 " "

2349 " "

Skull

large

2633 large? cranium + up. mandible

~~2633 lower mandible tip~~ (seems small to 2633)

2350 up mandible

small

2205 mt some restoration

2293 mt rostrum

2204 cranium

2624 top of cranium

2293 up. mand tip size ?

2634 top of mand + up + lower small?

2515 up mand. small

left 2511 post artic. of low. mandible

2074 (2) " " " " " mt left

2107 upper mandible

* = monographed

Mancalla diegensis —

Ulna — 7 (1 monographed) 6 new

Large right
- * 2064 } ap. complete
- 2323 }
- 2248 prox
- 2509 dist
- 2257 nearly comp. large or small?
- 2287 may be small?

left 2337 (or 4079) may be small

16 new — 21. (5 monographed)

Small

left
- approx complete: 2439 may be large; * 2179; 2484 may be large; 2552
- olecranon fragment: * 2079; 2558; * 2069 may be large ~~Not monographed?~~; 2342

no # loc 121 mt

rt
- * 2082, 2497, 2497 — essentially complete
- 2485
- 2258 dist bar
- * 2101, 2635, 2294, 2306, 2485, 2556 — incomplete

no # loc. 1075 mt

Radius (6)

large: 2486, 2567, prox 2238

small: 2335 mt (left), 2632, 2274 (+2 pcs.)

Carpometacarpus — 7 (2 monographed) 2 new

large
- left 2542 complete rt 2541
- left * 2060 ✓ prox rt 2305
- prox frag * 2092 ✓ manipulo rt 2066 ✓
- prox 2223 may be small

6 new — 13 — 10 (4 monographed)

small

left
- ~~2 [illegible] prox~~
- ~~large? 2042 prox frag~~

no # mt loc 101

2245 rt prox

2288 rt ~~2 frags~~ incl. prox frag + dist. "

rt
- * 2068 complete +
- 2068 ✓ prox end
- 2487 incomplete
- 2433 (?) "
- 2249 (?) "
- 2650 " small-large?
- * 2159 " complete mt
- 2213 complete mt
- 2436 " incomp.
- * 2060 prox may be large

r = monopefilus

Mancalla diegensis

Femur

large 5

left 2507
• 2078 } distal 1/2 - 3/3
• 2137 }

2672 (R or L?)

2227 middle 3/4 may be small

2668 proximal

small 13

complete left • 2097 mt

complete • 2185
prox • 2186, 2186, 2507
distal 2221, 2248, 2260

no # mt prox 3/4 mt
2508 nearly complete
2347 nic complete
• 2145 distal 1/2
• 2145 shaft
• 2162 nic. (sp?)

Tarsometatarsus

large 4

left
complete • 2178 (sp)
prox 2232 may be small?

mt
2224 nic 1/2 distal
2499 " " "
~~2499 [illegible]~~

small 15

left
complete 2489, 2327
distal 2499
prox 2498
sh + part d) distal 2499, 2557
distal 3/3 2275 mt

mt
2458, 2548 complete
2499 nearly complete
• 2091 yg? sh
• 2091 distal yg?
• 2072 frag. distal
• 2177 comp. mt
2224 frag yg.

Tibiotarsus

large 9

left
2308 comp.
2322 no prox
2273 distal

RT
2477 comp
• 2125 nearly comp.
2474 no prox
2550 nearly comp nic pro.
2320 distal

1 distal tobe #11 from recold TT amphibian

small 31

left
complete 2549
c. nearly so 2620, 2134
no prox • 2108
distal frag 2479
dist 2551, 2510, 2479 2671 (R or L?)
prox 2510
dist. 2577
dist. 2210 mt
prox no #

mt
2478, 2209, • 2083, 2286 comp or nearly so
2283 no distal
2233, 2438, • 2088 prox 1/2 frags
2479, • 2071, 2634, 2348, • 2104, • 2071, • 2084, • 2088, 2259, • 2089 distal 3 pcs
• 2177 comp. MT

Pelvis

2340 sacr part pelvis small
• 2182 MT incomplete
• 2165 sacrum
• 2139 " frg
• 2073 pelvis frg
• 2170 " frg

not monopefilus

1 = monographed (24) should be 27

Macaalla from San Diego

23 Humeri 10 radii?

22 new

Complete, large

left { Howard 9/4/49 loc. 1075
2480 ✓ – 1080

rt 2304 – 1080
rt 2670 – (near 1074)

Incomplete, large

left 2207 – 1075

rt { 2481 – 1080
2355 – 1094
2339 (badly eroded, size ?'d) – 1074

Proximal, large

58? Tecolote Canyon

2658 – 1077?
2331 – 1071 (in z pres?)
2643 rt – 1074

Distal, large

left { 2481 – 1080
2496 – 1128
2819 (size ?'d 1075A

rt { 2432 – 1080
2296 – 1080
2228 – 1080

Shafts + misc frags large

left { 2430 shaft – 1095
2230 shaft (prox'l) 1080
2098 1080

rt 2505 shaft – 1075

left 2659 sh large? – 1095

left 2540 dist size? not same size as 2505 rt. 1080

have 7 instead of 6 (2505's)

2664 (sh 1071

2440 bent 3400 Reynard (E) ?, one with no #?

2641 complete, adult 1149

2554 (prox) 1071

2350 shaft frag 1095

2505 left 1071

2318 dist 1075A

2280 dist 1080

2332 dist frag 1071

2272 shaft 1075

2206 (prox end)

2481 (shaft)

2496 (should be 7 inc – 1128 missing

2637 (1 of 3 frags missing, 1080

2644 (dist 1074)

30 radius.

1080

Complete small 70 bones

2363 in mt
2353 – 1071 2480 ✓ } 1080
2427 2504 } rt – 1075
2219 – 1075 2442 in mt – 1075

3228 Reynard

left
2292 – 1080
2326 – 1075
2480 ✓ – 1080
2480 ✓ – 1080
2206 – 1075

? is this 2641?

no #
2051 – 1080
5096 – 1080
2096 1080

Incomplete small

2206 left – 1075 · 2084 rt 1080
2231 – 1080 · 2080 1074
2537 – 1080 rt → 2280 – 1080
2332 – 1071
2481 – 1081

Proximal small

left
2505 – 1075
2554 – 1071
2343 – 1074
2496 – 1128
2505 – 1075
2496 – 1128

rt
2538 (~~bent~~) 1071
2318 – 1075A
2538 – 1071
2644 – 3400 Reynard (E)
· 2077 – 1071
· 2066 1071
· 2066 1071
· 2066 1071

2496 (may be large?)
2206 + 1075
2289 – 1080 (with dist. c) same #?)

Distal small

left
2251 – 1075
2644 – 1074
· 2135 1080
· 2062 1072
· 2062 – 1073

rt
2539 – ?
2539 – 1071
2539 – 1071
· 2183 1071
· 2066 1071
· 2183 1071

only 2 in book

Shafts + frags. small

left
· 2146 (prox – 1080
· 2065 (" – 1076?
· 2065 (dist – 1076?
1082 2637 prox yg
2554 prox – 1071
2505 dist – 1075

rt
· 2159 (prox) 1075
· 2103 (") 1080
· 2066 (") 1071
· 2093 (shaft) 1080
· 2149 (") 1080
2481 (~~prox edge~~) shaft (prox'l)
2496 (~~prox~~) " (prox'l)
2496 prox yg – 1128
2505 " " – 1075
2505 " " 1075

2637 Shaft (prox'l) 1080
2206 prox tip does not fit shafts like above

1075

Cormorant – Plocamia San Diego

Hemimera

	Br post	Br ant. post. abdom. groove	Head to eyestem	Depth of head	Br at gular surface
2121	21.4	19.9	6.5	9.1	
pelagica 26	20.8	19.5	4.5	8.5	
penicillata 670	21.8	19.6	6.7	9.1	
" 497	22.3	20.5	6.7	10.0	
pelagica 453	21.3	19.4	4.2	8.2	
aurita 257	24.4	22.2			

Size of hemimera between pelagica & penicillata,
Excav. of br. furrow deeper than in penicillata (shallow in pelag.) Probably more than in aurita
Edge of deltoid crest less thick than pelag.
Palmar contour & capital groove shows very obtuse angle & gentle slope as in aurita & pelag. More acute groove in penicillata,
Hemimera is slightly broader with shallower head & broader & shallower Cr. capitalis furrow than P. femoralis

$$27.7 : 56.5 = X : 93$$
$$56.5X = 2576$$

$$9.7 = 22$$
$$14.4 = 31$$

$$25.2 : 56.5 = X : 93$$
$$56.5 =$$

26.2 / 93 / 786 / 2358 / 2436 / 2260 / 1766 / 1130 / 636 / 506

25.2 / 93 / 756 / 2268 / 2343 / 2260 / 836

277 / 93 / 831 / 2493 / 2576 / 2260 / 3161 / 2825 / 336

Pliocene Type Coracoid of Cormorant

	Depth of pel. head	Length of pel. head to articular surface	Length of pel. head to Procoracoid	Breadth of pel. head	Depth of pel. head	Breadth of pel. head (distal)	Depth of pel. fossa (anter.)	Depth of pel. head to depth of fossa	Depth of pel. head at articular surface	Depth of pel. fossa to procoracoid
fossil										
2127	11.6	21.7	21.0	5.8	6.0	9.6	8.3	4.7	9.9	6.2
Pelecanus 670	(11.0)	(22.7)	(22.0)	(4.7)	(6.1)	(10.0)	(2.3)	3.6	11.9	6.7
pelagicus 3/4	11.0	21.8	21.	4.7	6.2	9.7	8.3	5.0	10.0	5.7
453	10.4	21.0	20.5	4.4	5.7	9.2	7.7	4.9	9.5	5.1
826	11.0	21.6	20.9	4.0	5.0	9.4	8.2	5.2	9.4	5.3
Penis 497	(10.9)	(22.0)	(21.5)	(4.7)	(6.0)	(9.6)	(7.7)	(3.4)	11.0	6.3
auritus 257	12.7	24.4	23.7	5.3	6.7	11.6	8.8	5.7	11.0	6.7
382	11.7	23.5	22.4	4.9	5.9	11.2	8.2	5.4	10.9	6.7
auritus 7/40	12.5	23.7	23.1	4.1	6.4	11.1	8.7	5.7	11.9	7.0

	Length of articular end	Depth at fossa	Breadth at fossa
Phalacrocorax fossil 2115	12.7	5.7	2.7
auritus 257	12.8	5.4	3.0
Aperdix 354	11.4	5.4	2.7
pelagicus 824	10.2	4.3	2.6

Furcula: appears a little larger for the coracoid. Shaft deeper & heavier than in any modern form. Hypocleidium and abdorsal as in auritus being but characters are closer to penicillatus & pelagicus

① Shaft bears plunge on dist. border proximally

② Swelling on external side just to articulation

This area proceeds more vertically from the articular surface than in auritus, or even penicillatus closer to pelagicus. No [illegible] more marked even than in that species.

The bone appears to be closest in size to pelagicus though in many dimension penicillatus is similar. The length (which is greater in fossil than in pelagicus) cannot be determined in the fossil.

The procoracoid is more developed than in pelagicus & more closely resembles auritus.

The process from procoracoid to head of pel. head is straighter than in pelagicus (pelagicus bends anteriorly) both penicillatus & auritus are straight.

~~The shape of the head, except for the bend is nearest pelagicus the [illegible]~~

The degree of depression on the internal side between the head the fossil is closest to pelagicus but there is a greater plane forward of the head [illegible] itself in the fossil - as in auritus.

Excavation of the neck region resembles pelagicus & auritus rather than the marked excavated cond. of penicillatus. The relative position of the head back of the furcular facet also resembles pel. & auritus.

The other Pliocene cormorant is marked by longer,

Loon - San Diego

Humeri

	gr br dist	br dist cond only	ht ext cond diagonally	br dist across mid	depth ext cond	depth thru side thru cond	depth shaft thru branch imp.	Dist top of ext cond post edge shaft	Dist top of ext cond post edge shaft to base of Bicipital crest
2131	13.1	10.1	7.7?	11.5	7.4?	8.0?	4.6		
2111 Brightsmith Typing & Measurements	13.6	10.1	8.1	11.3	8.4	9.1	5.1	6.5	
2133	12.3+	9.7	—	11.0	—	—	4.9		91.1
nuttalli 328 stellata	14.2	10.5	9.0	12.5	8.5	9.3	5.7	6.5	
Ethm 327	13.4	10.3	8.3	11.8	8.6	9.1	5.0	6.2	106.5
1020		10.7				9.5	5.3		112
stellata 788		10.5	8.7			9.3	5.0	6.4	108.6
pacifica 304	15.1	11.7	9.5	12.4	9.0	10.1	6.0	7.0	
28		11.3				10.6	5.8		120
673		10.8				9.5	5.0		113.1

a Premaxilla

	Br at gnat end nasal	Depth same place	Br nasal pros at premax	groove br at	br ant proc. ht same place	Ratio ba	Ratio ca
2110	7.2	5.5	4.8	1.5	3.0	76.4	66.7
stellata mod 1020	6.0	4.2	3.6	1.0	2.4	70	60
Ethm 327	5.3	4.2	3.3	1.0	2.0	79	62.3
328	5.5	4.5	3.4			82	62
pacif 304	6.6	5.5	4.1	2.2	2.0	83	74.4
28	6.9	5.3	4.0	2.5	2.4	76	75.5
nuttalli 1115	9.1	9.1	7.3			100.0	80
830	7.7	8.1	6.9			105.9	78

Miozula

	Type length ulna	depth ext. post. shaft	depth sh. prox. (cf.)	depth sh. mid	depth int. mid post	Tibia br. dist.	length fibula	C or sh. above dist. end	rest br.	br. int. cond	hor. int. cond	depth ext. cond	gr. depth dist. artic. facies post.	br. post. obt.	br. sh. at center Bel. int.
M. media	140 136.2	15.4	10.7–? 11.4	9.6–10.0 10.5		13.7	—	10.8	79.0	4.0	9.6 10.0	10.0	—	~~14.5~~	~~8.2~~
SD. fosil	—	14.7	9.2	9.0	13.2	14.0	13.5 est. 115 sp.	11.1	79.4	5.2	~~8.0~~	11.3	13.0	14.7	7.0
M. bassanus															
18045		17.5	10.4	8.5	16.2	13.0	105.0			3.7	8.2	10.7	12.4	16.5	8.2
18046		17.3	10.6	8.5	16.0	13.1	100.3	9.6		3.7	8.2	10.3	12.3	16.5	8.0
Sula															
1356 ✓	Sactefleber	16.0	12.3	7.6	14.1	14.1	94.6	12.6		3.5	8.0	9.8	12.1	14.3	7.6
250 ✓	Greenbar	14.1	10.7	7.2	13.0	11.9	77.2	10.0		3.4	6.4	8.0	9.9	13.2	7.1
253	Redmond	14.2	11.0	6.5	12.4	11.2	82.5	?		3.0	6.9	8.6	10.2	13.0	6.5
1339	Sula	15.5	11.3	7.2	13.2	11.3	76.3			3.4	6.3	8.3	9.1	14.6	7.1

Ulna

from fib/fib. cond to flat surface but, (Fib just gave, gave grove) groove and Female - S.D. Female Tibia

	Gr dist	Gr sh	depth sh	Depth fib cond to groove	Depth ex cond no groove	ratio cb	Ratio da	depth outside femur tibia bent under					
										x	y		
										Gr sh pat.	trace two cheek cuts	Ratio xy	
2118	10.5	4.0	4.9	8.1	7.8	122.5	77%	3.5	2129	4.2	7.4	56.5	
Bi annis													
B1 1674	10.6	3.8	4.6	8.6		120	81.2				5.1		
1593	10.0	4.0	4.7	7.8		117	78			4.0	6.0	66	
1625	10.1	3.8	4.3	8.3		118.8	82.3			4.3	5.3	81	
1628	9.6	3.7	4.3	7.8		116.1	81.3			3.7	5.1	72.5	
1627	9.1	3.6	4.2	7.2		116	79.1						
1623	9.2	3.6	4.2	7.1		116.3	77.2						
Acetv.													
857	12.0	4.7	6.0	9.6		127	80			5.3	8.0	66.3	66.3
479	12.1	5.0	6.1	9.8		127	78.5			5.0	8.0	62.5	
540	13.7	5.5	6.8	11.4		123	83.5			6.2	8.5	73.0	
Tolbacchi													
671	12.7	5.6	6.5	10.2		116	80.7			4.9	7.7	63.4	
634	13.1	5.0	5.5	10.0		110	76.4			4.8	7.3	65.7	
Nig. 621	8.1	3.2	3.7	6.3		115.7	77.7	2.4					
503	8.2	3.1	3.7	6.0		119	73.2	2.4			3.1		
521	8.0	3.3	3.7	6.1		112	76.3	3.0					
387	8.6	3.2	3.8	6.7		118	77.9						
1767											6.7		
950										3.6	6.3	57	

	Femur				Tibia						
	br. dist	br sh	depth sh	Caliper depth to br. ✕	length	br dist trochs	depth int cond	depth ext cond	br prox	br sh dist	depth sh dist
C. hol.	12.3	5.2	5.8		98.5	9.4	9.3	9.7	10.0	5.4	3.5
	14.1	5.9	6.7		109.6	10.0	10.5	9.8	10.4	5.7	3.7
C. auritus	9.7	3.6	4.2		69.6	6.5	6.8	6.5	7.3	3.4	2.3
	11.0	4.0	4.8		78.1	7.3	7.7	7.3	8.2	3.8	2.7
large fossil					97.2	9.0	8.8	8.4	8.8	4.7	3.1
					102.5	9.1	8.9	8.5	9.2	4.9	3.3
small fossil	10.5	4.1	5.0						8.0		

	a Calipers gr depth	b HM1	c Gr trochs	d Depth ext	bg Ratio
2136	8.4	6.2	3.8	7.2	73.8
1624 C. auri	7.4	5.9	3.4	6.5	79.7
1625	7.2	5.5	3.2	6.3	76.4
C holbrooki 671	9.7	7.2	4.9	8.5	74.0
534	9.5	7.5	4.3	8.3	79.0

The lumen are small for carves of large for the other sp. Phone with distal end looks more like Arch than Col.

Calipers bet. hol. + aur. in gr. depth 1 prox.

2 geckos are present – ~~both~~ ~~assignable to Cobgymbus~~,
larger & similar to C. holbrooki
except for slightly smaller size (femur 10-12%)
2 Febis laevis
3 lumeri
~~Tibia~~ 1 tarsus (prox)

Small one agrees with C. auritus in size but is slightly heavier
Fibula, the fibular condyle is deeper and its proximal border with the ext. tuberosity is more anteriorly in position
Internally there is less construction of the shaft above the int. condyle

only tuberosity in tibia is greater flare of ext. cnemial crest
This is closer to Podarcis than Col.
The prox tip of this crest however is lower than in Pod.
A diagonal faint groove runs anteriorly from beneath the prox ext tuberosity is most closely approximated in Arch.

Grebe ~~Silver~~

	Length to ant. head	gr br dist	br dist touch only	Mean Depth int cond	Depth ext cond	br max width	br sh above dist end	depth sh above dist end	flare & tip alert	rates xy	xy rates modern
	102.5	9.9	9.1	8.8	8.5	9.2	4.9	3.1	7.3	79.4%	auto 86.9% - 53% c. hab 71.5
#2113	97.2	9.3	1.0	8.9	8.4	8.8+	4.7	3.3	~~7.0~~	—	c. aur 77.2 - 70.5
2729						8.0			7.0	87.5	Pod 92 - 85

	Length from anter edge bicaps sup	br dist	Humerus br sh mid	Humerus depth sh mid
2132	79.0	8.8	4.2	3.7
2131	—	—	4.2	4.1
mod. hot, mod anem	91.0, 68.5	10.5 7.9	5.2 3.9	4.7 3.4 area

	br max	Depth max	Ht hypo tarsus
2130	10.4	10.2	7.9
mod hot/anem	11.7	11.5	8.2

	br dist	br sh	Mean depth sh	depth int cond	depth ext cond
2118	10.5	4.1	3.0	7.8	7.8

Small alcidae

	bc humerus	ht at acet purple bones	Depth int. condyle	Depth ext. cond.	Dep. At sey. centra	ht. centrum	bc 2 trochl.
Miller's Sandpiper small Alcid	5.1	8.0	6.3	5.1			
Miller S.D. Puffinus	7.3	—	8.4	—			
Lanius, Newport Puffinus	8.3	11.1	10.1	7.3			
San Diego Vertebra					14	10.0	~~6.0~~ 6.0
Dist. tarsus San Diego							
Maccalla San Diego	7.0	14.4	9.5	8.1			

See also Maucalla

Data for 1949 paper

Carnegie Inst. Wash., Pub 584
no 4, pp 177-199